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PHILIPPINE ISLANDS

Vol. VI

Annual Report of the Director of Forestry of the Philippine Islands for the years ended December 31st, 1916, 1917, 1918 and 1919.

Philippine Bamboos. By Wm. H. Brown and Arthur F. Fischer. Bulletin #15, Department of Agriculture and Natural Resources, Bureau of Forestry.

Philippine Forest Products as Sources of Paper Pulp. By Wm. H. Brown and Arthur F. Fischer. Bulletin #16, Department of Agriculture and Natural Resources, Bureau of Forestry.

Philippine Mangrove Swamps. By Wm. H. Brown and Arthur F. Fischer. Bulletin #17, Department of Agriculture and Natural Resources, Bureau of Forestry.

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THE GOVERNMENT OF THE PHILIPPINE ISLANDS
DEPARTMENT OF AGRICULTURE AND NATURAL RESOURCES
BUREAU OF FORESTRY

Annual Report of the Director of Forestry of the Philippine Islands

For the Fiscal Year Ended December 31, 1916

ARTHUR F. FISCHER
Director of Forestry

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ANNUAL REPORT OF THE DIRECTOR OF FORESTRY.

MANILA, P. I., *March 1, 1917.*

SIR: I have the honor to submit herewith the annual report of the Bureau of Forestry for the fiscal year 1916 covering the period from January 1 to December 31, 1916.

The Director of Forestry left Manila on January 12, 1916, on leave of absence, resigning December 1, 1916, taking advantage of the Osmeña Retirement Act, without returning to the Philippine Islands. Mr. W. Klemme, Chief of the Division of Administration, was designated as Acting Director on the date of Mr. Sherfesee's departure; Mr. Klemme resigned on April 10, 1916, also taking advantage of the Osmeña Retirement Act and the undersigned was thereupon designated as Acting Director.

PROPAGANDA.

As in the past, the Bureau of Forestry has vigorously carried on the campaign of education in acquainting the people with the forest laws and their benefits, with the goal in view of making the people realize that forest officers exist not only to detect and penalize infractors, but rather to help the individuals in every way possible in the wise use of their forest wealth, and special attention has been given to reforestation propaganda in municipalities having large grass areas. Headway has been made in getting the people themselves to realize that unwise use and destruction of the forest wealth in their municipal jurisdiction means lessened economic independence and many municipal and provincial officials have aided the Bureau in carrying out its work.

Forest officers still carry on their informal talks on their field trips and answer questions in reference to the use of the forest, possible markets for local forest products and homesteading of public lands. During the year, 1,710 informal talks were given and 56,350 people addressed at these meetings in their own dialects. Forestry leaflets outlining work of the Bureau were published in serial form in the various newspapers of the Islands. The Bureau appreciates the cordial support of the various editors in putting the matter before the public.

LEGISLATION.

Act 2608 was passed by the Legislature on February 4, 1916. This Act was repealed and replaced by section 1030 of Act 2657 (Administrative Code) which reads as follows:

> Sec. 1030. *Leasing of forest land for special purposes.*—The Director of Forestry, with the approval of the Secretary of the Interior, may, upon proper terms which he may deem reasonable, lease, as herein provided, forest land as sites for sawmills and timber depots, and for the construction of hotels, sanatoria, residences, or for camps, fish-ponds, pastures, or other lawful uses, for a period not to exceed twenty years and not more than ten hectares in area, except so far as fish-ponds are concerned, in which case the maximum area shall be two hundred hectares, and pastures, the maximum of which shall be one thousand hectares, to any person or to any association of persons.
>
> The Secretary of the Interior may grant free rights of way through any public land to enable the holder of such special permit or license to get access to the land in question.

Before this section could be put into operation it was declared unconstitutional as not being in accordance with the Act of Congress of 1902.

On July 1, 1916, Act 2657, commonly known as the Administrative Code, went into effect. All forest laws were simplified in language without lessening the power conferred under the old laws, and were included in the Code from section 1007 to section 1034.

Act 2649 was passed February 24, 1916, appropriating ₱10,000 for the reforestation of lands included in certain Government friar estates which were covered with cogon and not fit for agriculture. Accordingly steps were taken to reforest one of the most denuded estates on the Island of Cebu. A discussion of the work accomplished in this direction is given elsewhere in this report.

The sum of ₱18,000 was appropriated by Act No. 2583 passed February 4, 1916, for the completion of the administrative building of the Forest School and for the construction of quarters for the students of the School of Forestry at Los Baños.

Act No. 2613, enacted February 4, 1916, allows any producer of tobacco a gratuitous license to cut timber of the first group for the construction of warehouses exclusively for the curing of tobacco.

The Jones Act became the new organic law of the Philippine Islands August 29, 1916, and it conferred increased power in legislative matters and provided a Senate and a Legislature, but restricted legislation in regard to forests, lands, and mines to the extent that any proposed law along these lines must go to the President of the United States for final action.

During the session of the Philippine Legislature which has just closed at the time this report is being prepared, a number of bills of great importance to the Bureau were introduced, some of which passed the House of Representatives but not the Senate, while others passed both Houses.

In November, 1916, Bill No. 178 passed the House of Representatives providing for the consolidation of the Bureau of Lands and Forestry and was forwarded to the Senate.

House Bill No. 294 was introduced providing for the distribution of charges on forest products, one-half to go to the Insular Government and one-half to be equally divided between the province and municipality in which the charges were collected.

House Bill No. 459 provided an annual appropriation of ₱5,000 for the reforestation of cogonales in locust infested regions and in known breeding places of locusts on uncultivated waste lands.

House Bill No. 473 provided for an appropriation of ₱500,000 for the establishment of a Government sawmill in the Department of Mindanao and Sulu for the supplying of timber for public works.

Senate Bill No. 1, known as the infant industries bill, provided for an appropriation of one million pesos for the establishment of a paper mill, as well as certain other industries.

Senate Bill No. 17, which is essentially the same as section 1030 of Act 2657 (declared unconstitutional), was reintroduced with the provision that after approval of both houses it was to be presented to the President of the United States for final action.

NOTE.—The Legislature adjourned February 17, 1917.
House Bill No. 178 failed of passage in the Senate.
House Bills Nos. 294, 459, 473 failed of passage in the House.
Senate Bill No. 1 failed of passage.
Senate Bill No. 17 passed the Senate and House and goes to the President for action.

THE OFFICE OF THE WOOD EXPERT.

No important changes have been made in this office during this year, but a great deal of material has been added to the files in all branches of information regarding the botanical identification, local names, properties and uses of timber trees and plants producing minor products.

There have been received over 1,300 numbers of botanical specimens from forest officers and the Bureau of Science has returned from this material duplicate specimens to the number of 1,464, which have been redistributed to the forest stations in the districts where they were collected. The systematic distribution of such duplicates was begun in the latter part of 1914 and there are now over 3,000 sheets in the forest station herbarium cases. About 200 wood specimens were collected with botanical material and, from forest officers' collections and all other sources, over 300 trade samples were received and identified.

The preparation of hand specimens and similar work has been very much facilitated by a small saw table installed in March. This has made it possible to work up much old material which it was impracticable to work up by hand, so that, whereas the previous year there were on hand for sale or distribution specimens of some 200 species, there are now available about 250. During the year there were distributed to forest stations 669 hand specimens; 2,199 were furnished to the Forest School, 600 sold, and 1,874 distributed gratis to institutions, firms, and private persons.

As against 600 phenological reports received in 1915, with some 3,000 trees reported, in 1916 there were received 800 reports, aggregating 4,764 trees named. All of these are recorded in a card index, thus adding a large mass of data regarding distribution and local names in easily accessible form. Also there have been added to the index the local names from 1,368 trees named in the 42 lists of local synonyms received during the year.

The list of foreign specimens has been increased by over 200 numbers. About 26 numbers have been added to the collection of 10-foot planks and about a dozen logs of new species have been worked up and installed.

The scaling sticks first devised and put into use in 1915 have been somewhat improved. Over 50 are now in use at various stations and are giving good service.

A number of inspections of lumber were made during the year. Among the most important were: Identification of about 4,000 ties received in Manila from Mindanao and Sulu; identification and inspection of 104,606 feet of Almon lumber for the Naval Station, Cavite; identification of various lots of logs received by Manila brokers from licensees.

In addition to the routine work of preparing wood specimens and planks and logs for the working collection, there were prepared seven sets of 6-foot planks of 13 species each, for installation in forest schools and other public institutions in the States. In connection with the rearrangement of the collections on the ground floor there has also been an unusual amount of mechanical work. Both the planks and the logs have been reviewed and relabeled in accordance with the latest botanical information, and, for the first time since the collections were begun, have been rearranged completely by families and genera. About 300 species are represented by logs and some 140 by 10-foot planks.

Bulletin No. 14, "The Commercial Woods of the Philippines: Their Preparation and Uses," came from the press in December.

LIST OF LOCAL AND OFFICIAL TREE NAMES.

During the year, there was compiled in the office of the wood expert, a list of official and local names of trees by provinces throughout the Islands. Local names of trees are so confused that sometimes a first-group tree is invoiced as a fourth-group tree by the licensees, or vice versa, and the list was prepared to avoid this confusion. Copies of the list were furnished to all provincial and municipal treasurers, district engineers, and to other parties who have to do with lumber, for their guidance in all the transactions involving the invoicing of timber under proper official and commercial names.

FOREST MAPS.

There has been a notable increase in the work of this section during the year, due partly to the greatly increased field work accomplished by the larger number of forest stations and partly to the reconnaissances that have been made.

The following table shows the number of kilometers of trail notes and of hectares of forest surveys made by the field force in each district, the trail notes already received and filed in Manila and those still pending in the district offices being shown separately.

Trail notes.				Forest valuation.
District—	Received.	Pending.	Total.	
	Kilometers.	*Kilometers.*	*Kilometers.*	*Hectares.*
No. 1	291.12	11.29	302.41	9
No. 2	171.90	55.51	224.41	27
No. 3	36.60	4.70	41.30	----------
No. 4	450.87	106.86	556.78	9
No. 5	536.06	225.02	761.08	92
No. 6	493.66	504.19	997.85	28
No. 7	990.82	403.90	1,394.72	95
No. 8	538.43	169.77	708.20	62
No. 9	162.18	36.92	199.10	18
No. 10	3,296.87	59.35	3,356.22	530
No. 11	387.60	140.08	527.68	6
No. 12	70.01	19.39	89.40	2
Totals	7,425.62	1,733.48	9,159.10	878

The sketches and original notes have been arranged and filed in the map section, to be included as rapidly as possible in the base maps. Trail notes of over 5,000 kilometers and surveys of over 550 hectares have already been compiled on the 1:100,000 base maps and a number of kilometers in regions designated as concessions, reserves or forest zones have been compiled on a scale of 1:20,000. Besides this work, there have been made 83 communal forest maps, the forest map of the reconnaissance of Agusan Province on a scale of 1:200,000 for engraving, and the map of the reconnaissance of Samar on a scale of 1:200,000.

The chief of the section spent 102 days in the field, personally supervising the work and directing the several field parties in the reconnaissance of Samar, during which he traversed almost every part of the Island. In addition, he attended a number of hearings in Negros, in connection with the Cadastral Survey and the Negros-Philippine Lumber Company, and in Laguna, relating to the Mount Maquiling Forest Reserve.

The ranger assistant to the chief of the section was in the field 171 days. During this time he inspected the forest areas claimed by private persons inside the area of the Negros-Philippine Lumber Company, the forest zone in Isabela, Occidental Negros, in connection with the Cadastral hearings, and made a forest reconnaissance of the timber in the coal bearing regions in Polillo and Alabat Islands.

The other five rangers attached to the map section spent all told 203 days on various kinds of work in the field.

The perfecting of land titles in the courts is a matter of such importance that it deserves especial attention. The lack in the maps and plans of details regarding soil cover on a parcel of land and the incompleteness of the silvical data in many regions are obstacles that appear every time there is received notice of court proceedings for the registration of a title. All of these notices have to be carefully examined to secure the necessary information regarding the location of the land and the character of the soil and vegetation in order to decide whether it is or is not advisable to take action in opposition to the claims.

The following table shows the status of the claims received during 1916:

Number of notices of hearings.

Case.	Number received.	Action taken.	No action necessary after inspection.	Pending decision of court.	Number of hectares adjudicated to Insular Government.
Cadastral	61	6	1	2	19,157.90
Ordinary	980	31	11	13	1,242.59
Total	1,041	37	12	15	20,400.49

It is noteworthy that a total of 20,400 hectares of commercial timber was practically saved from denudation for the Government, a goodly per cent of which can be classed as permanent forest land and will finally be included in forest reserves.

As the various details of information in these cases pertain to several different bureaus, there will be submitted in the near future, for the approval of the Department Secretaries, a basic outline for an economical and practical procedure of coöperation among the several bureaus.

ESTABLISHMENT OF FOREST ZONES, THE BASIS OF FUTURE FOREST RESERVES.

The many practical difficulties encountered in establishing and proclaiming a forest reserve, such as a personnel lacking not only in numbers, but also in capacity to comprehend all the factors involved in such vast projects, the uncertainty of the legal status of many parcels of land, which often makes it impossible to decide whether they are or are not to be included in a reserve, the question of the nomadic hill people, and many others, have given rise to the plan of leading up gradually and progressively to the establishment of forest reserves by the preliminary delimiting of forest zones.

Forest zones differ from public forest only in that, in forest zones, closer and more detailed work and more exacting requirements are demanded, where any of the included area is to be alienated; the intention being eventually to have all or parts of such areas set aside as forest reserves. The delimiting of a forest zone in each region of the Archipelago is a matter of the highest importance, for on it depends the conservation and proper exploitation of our forest resources, as well as their future development and, finally, the setting aside of lands suited for permanent agriculture.

There are extensive forests the soil of which is well fitted for one or another of the crops ordinarily cultivated in the Philippines, but the quantity and quality of the stand of timber in them and their accessibility for exploitation make it more advisable to extract the timber before throwing the land open to cultivation, in order not to waste the thousands of pesos that the sale of the timber could and should bring in. These areas are generally exploited under ordinary annual licenses; in some five years or so, the licensees use all the timber, paying its value into the public purse, and the land is then certified and at the disposal of the Bureau of Lands, to be occupied by homesteaders, purchasers or lease-holders.

Through the delimitation of forest zones there would be certified to the Bureau of Lands great areas already inspected, which could be made available at once for occupation in accordance with the Public Land Act, instead of waiting for applications for individual parcels, which frequently are not so well fitted for agricultural purposes; at the same time, reserves could be definitely established without extraordinary expense and without diminishing the utilization of forest products.

PRIVATE WOODLANDS.

The fact that the greater number of applications for registration of land titles are decided by the courts of various judicial districts in favor of the applicants and that the people are gradually gaining a better knowledge of the laws have both tended to cause a constant increase in the number of applications for registration of private forests as provided in Section 1021 of the Administrative Code. The majority of such applications are for land of a distinctly agricultural type, which, however, contains small scattered stands of timber or else scrub forest suitable for domestic uses or to supply small industries. The applications for really forested land are extremely few, and such as have been registered with the Bureau are generally based on some "Titulo Real" of the Spanish régime or a Torrens Title acquired years ago, when, not being informed of the hearings in these cases, the Bureau of Forestry could not enter any opposition.

In the case of brush land, the procedure for granting the certificates is brief, consisting merely of an examination of the title deed and an inspection of the land by a forest officer, a sketch map made by him serving at once to locate the parcel and to compare its area with that stated in the title deed in cases where the title has not been perfected or no plan exists. In case of forested land, the procedure is somewhat stricter, the applicant being obliged to submit, not only a perfected title, but also a plan showing exactly the location, boundaries and area of the land in question, the plan serving the purpose of preventing boundary disputes with licensees in adjacent public forests, or the fraudulent extraction of forest products outside of the private land. Another important purpose of the plan is that it serves the forest officer as a base for the measurement of the forest area in order to determine the amounts and kinds of timber on the property, which information is furnished the Bureau of Internal Revenue to serve to some extent as a check on fraudulent use of registry.

The following table shows the private woodlands registered in the Bureau of Forestry:

Registered private woodlands.

Calendar year.	Number of—.			
	Parcels.	Hectares.	Ares.	Centares.
1900	420	20,648	68	51
1901	201	68,886	06	95
1902	23	16,412	27	44
1903	3	1,305	94	65
1904	8	29,228	47	82
1905	12	6,631	63	89
1906	21	12,736	95	24
1907	17	28,838	73	05
1908	10	585	97	53
1909	14	6,215	86	62
1910	4	8,653	85	22
1911	5	533	67	26
1912	14	6,552	84	89
1913	26	15,229	58	36
1914	16	23,230	05	07
1915	27	18,304	86	95
1916	37	51,663	77	49
Total	859	309,602	26	94

INSPECTION.

During the year detailed inspections were made of Districts 1, 6, and 10, and of the subdistrict of Surigao in District No. 8. These field inspections comprised thorough investigations of all the activities of the various forest officers stationed in the districts inspected, and at the same time direct instructions were given them concerning all the policies as well as the progress in administration of the Bureau.

The methods employed by the forest officers in their work were studied by the inspector and methods for increasing efficiency were devised. Where forest officers in the field were in doubt concerning methods of procedure, the proper solution was explained and also practical instructions given to them in field work.

The forest inspector, under special authorization from the Insular Auditor, was enabled to condemn such nonexpendable Bureau property as was unfit for service and beyond repair.

The attitude of the various forest officers toward the general public was looked into carefully, especially in the handling of caiñgin and land cases and infractions of the forest law. It is regretted that inspections of all districts could not have been made during the year, and it is hoped that during the coming year it will be possible to make an inspection of each district.

DIVISION OF ADMINISTRATION.

The division of administration is charged with the use and protection of the forests of the Philippines. The work consists of issuing licenses for forest products, inspecting the work of licensees, investigating the extent of forest resources in a given region, and examining public land as to its fitness for agriculture or forestry.

In connection with this work, trail notes are taken, the destruction of forests through illegal clearings is prevented and the offenders when found are apprehended and brought to trial. Persons who are in unlawful possession of timber or other forest products are reported to the municipal treasurers in order that the prescribed forest charges may be collected.

Other lines of work are the securing of information concerning forest products, the collection of herbarium material and wood specimens and the investigation of forested land claimed by individuals. The last is becoming an increasingly important part of the work of a ranger.

PERSONNEL.

At the end of the year there was on the rolls of this division the following force: Four foresters, 92 rangers, and 21 guards, making a total of 117 men, an increase of 10 over the previous year. One of the foresters is absent on vacation, another is in charge of Mindanao and Sulu, where large lumbering operations are being carried on, the third is in charge of District 5, where he, in addition to his other duties, teaches forest law and procedure in the Forest School. The fourth is acting chief of the division of administration.

For administrative purposes, the Philippines are divided into 12 districts and to take advantage of better mail facilities two more districts will be established in 1917 by dividing districts which are too large. New stations were established at Ilagan, Isabela; Masinloc, Zambales; and Butuan, Agusan, making 42 forest stations in the Islands.

CLASSIFICATION OF WORK.

The accompanying table (pages 15 and 16), showing how the time of the rangers was spent, scarcely needs any explanation. Forty per cent of the time was spent in the sale of timber and forest products to licensees, for that is what the issuing of licenses and supervision of licensees really means.

About 25 per cent of the time was spent in inspecting public land in order to certify to its value as forest or agricultural land. The importance of this work will be understood when it is realized that attempts are constantly being made to claim or occupy thousands of hectares of public forest in spite of the fact that there are vast areas of public grass land suitable for agriculture.

Table showing number of days and cost of each class of work performed by the field force of the division of administration during the fiscal year 1916.

District.	Licenses.				Public lands.				Caiñgins.				Communal forests.			
	Days.		Cost.		Days.		Cost.		Days.		Cost.		Days.		Cost.	
	Number.	Per cent.	Amount.	Per cent.	Number.	Per cent.	Amount.	Per cent.	Number.	Per cent.	Amount.	Per cent.	Number.	Per cent.	Amount.	Per cent.
No. 1	692	47.26	₱2,884	50.96	325	22.19	₱1,309	23.14	73	4.98	₱301	5.32	60	4.11	₱219	3.87
No. 2	482	44.47	1,284	38.14	240	22.14	1,053	31.28	33	3.05	120	3.57	34	3.14	140	4.16
No. 3	195	36.38	710	49.04	15	2.80	78	5.38	46	8.58	164	11.33	1	.19	6	.41
No. 4	628	28.95	1,941	30.42	793	36.56	2,540	40.01	108	4.98	343	5.40	73	3.37	229	3.75
No. 5	761	27.16	2,207	21.62	860	30.69	2,759	27.03	189	6.75	583	5.71	45	1.61	157	1.54
No. 6	1,158	39.32	3,752	38.88	695	23.60	2,275	23.57	216	7.33	898	9.31	99	3.36	357	3.70
No. 7	2,591	38.20	7,517	37.32	1,485	21.89	4,697	23.32	383	5.64	1,296	6.43	464	6.83	1,383	6.87
No. 8	2,910	52.15	10,350	52.25	1,102	19.79	4,237	21.91	208	3.73	767	3.97	161	2.88	529	2.74
No. 9	372	43.26	1,443	42.87	237	27.56	942	27.88	22	2.56	76	2.26				
No. 10	944	40.82	2,687	40.96	376	16.25	1,105	16.84	220	9.52	633	9.64	98	4.24	285	4.34
No. 11	1,853	43.02	4,726	40.59	970	22.51	2,939	25.25	166	3.85	520	4.47	157	3.64	534	4.60
No. 12	413	28.20	1,211	24.51	414	28.28	1,482	29.98	139	9.49	550	11.13				
Total	12,999	40.24	40,712	39.65	7,512	23.26	25,416	24.76	1,803	5.58	6,251	6.09	1,192	3.69	3,839	3.74

District.	Botanical collections.				Sundays and holidays.				Leave.				Reconnaissance.			
	Days.		Cost.		Days.		Cost.		Days.		Cost.		Days.		Cost.	
	Number.	Per cent.	Amount.	Per cent.	Number.	Per cent.	Amount.	Per cent.	Number.	Per cent.	Amount.	Per cent.	Number.	Per cent.	Amount.	Per cent.
No. 1	19	1.30	₱90	1.58	130	8.88	₱355	6.28	152	10.39	₱466	8.24				
No. 2	24	2.22	96	2.85	136	12.55	295	8.76	101	2.76	220	6.54				
No. 3	15	2.80	32	2.21	57	10.63	171	11.81	14	2.61	36	2.49				
No. 4	30	1.38	72	1.14	300	13.83	717	11.30	184	8.48	376	5.92				
No. 5	56	1.99	145	1.42	368	13.14	1,109	10.87	190	6.78	720	7.05				
No. 6	29	.99	116	1.20	383	13.01	917	9.50	142	4.82	373	3.87	81	2.75	₱194	2.01
No. 7					927	13.66	2,059	10.23	395	5.82	910	4.52	211	3.11	638	3.16
No. 8	89	1.60	257	1.33	725	13.02	2,229	11.53	375	6.73	968	5.00				
No. 9	13	1.51	68	2.01	136	15.81	419	12.40	43	5.00	130	3.86	37	4.30	301	8.81
No. 10	27	1.16	130	1.97	271	11.71	608	9.26	88	3.80	176	2.68	250	10.80	704	10.73
No. 11	100	2.32	291	2.50	585	13.57	1,297	11.10	281	6.52	624	5.36				
No. 12	17	1.17	64	1.30	221	15.09	657	13.29	84	5.75	194	3.93				
Total	419	1.30	1,361	1.32	4,239	13.12	10,833	10.55	2,049	6.34	5,193	5.06	579	1.79	1,837	1.79

Table showing number of days and cost of each class of work performed by the field force of the division of administration during the fiscal year 1916—Continued.

District.	Nurseries.				Patrol trail and trail building.				Miscellaneous.				Travel.			
	Days.		Cost.		Days.		Cost.		Days.		Cost.		Days.		Cost.	
	Number.	Per cent.	Amount.	Per cent.	Number.	Per cent.	Amount.	Per cent.	Number.	Per cent.	Amount.	Per cent.	Number.	Per cent.	Amount.	Per cent.
No. 1									13	0.89	₱33	0.59				
No. 2	1	0.09	₱2	0.06					30	9.31	118	3.51	3	0.27	₱38	1.13
No. 3					139	25.93	₱115	7.94	54	10.08	136	9.39				
No. 4									53	2.45	131	2.06				
No. 5	2	.07	17	.17					327	11.67	2,494	24.44	4	.14	15	.15
No. 6					4	.14	12	.12	122	4.14	601	6.23	16	.54	155	1.61
No. 7							30	.15	288	4.25	1,122	5.57	41	.60	486	2.41
No. 8																
No. 9																
No. 10									17	.73	48	.73	21	.97	184	2.85
No. 11	15	.35	56	.48	56	1.30	162	1.40	126	2.92	495	4.25				
No. 12									176	12.02	784	15.86				
Total	18	.05	75	.07	205	.64	319	.31	1,206	3.73	5,962	5.81	85	.26	878	.85

SUMMARY.

District.	Total days.	Total cost.	District.	Total days.	Total cost.
No. 1	1,464	₱5,667	No. 8	5,570	₱19,337
No. 2	1,084	3,366	No. 9	860	3,379
No. 3	536	1,448	No. 10	2,313	6,560
No. 4	2,169	6,349	No. 11	4,309	11,644
No. 5	2,802	10,206	No. 12	1,464	4,942
No. 6	2,945	9,650			
No. 7	6,785	20,139	Total	32,301	102,677

PUBLIC LANDS.

During the year, 6,989 parcels of public land were examined and reported upon as compared with 7,093 in 1915. There are pending for inspection 3,493 parcels, an increase of 1146 over those pending at the close of the previous year, due to the greater number of requests received.

This showing is very gratifying in view of the fact that applications for public lands are at greater distances than formerly from the centers of population and the inspections require greater care, as the land applied for is generally in or near the forest.

Considerable difficulty has been encountered by forest officers in inspecting areas applied for as homesteads because of other claimants to the land, which from all appearances is unoccupied public land. Some of the principal causes of these disputes are the following:

1. Tax receipts which are popularly considered as evidence of title.
2. Abandoned caiñgins which are claimed long after all evidence of cultivation has disappeared.
3. Fraudulent sales of uncultivated public land by individuals who claim to own it.
4. The claiming of cultivated public land by others than the occupant.
5. Previous homesteaders who, through failure to occupy the land as required by law, have forfeited their rights, but oppose new occupants applying for the area.
6. Clumps of bamboo and mango trees considered as evidence of ownership.
7. Overlapping of homestead areas because of no visible boundaries or labeled monuments, and because of vague descriptions by the several applicants for the land.

The above factors interfere with a bonafide homesteader, tend to discourage him in the development of a homestead and are liable to induce him to go so far into the forest as to be sure no rival claimants will trouble him, and there make a caiñgin.

Conflicts will become more frequent as more applications are received and it is necessary to adopt a rigid policy to prevent the destruction of forests by caiñgins, which is sure to increase if homesteaders are ousted from their areas or are hampered in the development of their homesteads.

One remedy for the prevention of conflicts is vigorous prosecution in cases where perjury has been committed; another and better method is the rapid extension of the cadastral surveys already inaugurated by the Bureau of Lands.

LICENSES.

There has been an increase by 120 in the number of ordinary timber licenses. There were 1,601 licenses in 1916. Of the licenses for minor products all but gutta-percha and rattan show an increase in numbers, the most significant increase being in firewood and dyewood, both entirely due to the war. The total number of licenses granted is 2,536 as compared with 2,307 in 1915. Details will be found in Table No. 7 at the end of this report.

With the increase in the number of licensees, greater difficulty has been encountered in the location of limits for licenses. Natural boundaries are used whenever possible, but the difference in local names for the same streams, trails and other features of topography are occasionally taken advantage of by rival licensees to acquire territory assigned to their competitors.

COMMUNAL FORESTS.

Eighty-one communal forests were established during the year as compared with 63 during the year 1915. Five more are being considered and will be established soon. The total number of communal forests now amounts to 360, distributed among the different provinces as shown in the following table:

Communal forests established in the Philippine Islands up to and including the year ending December, 1916.

Province.	Established until 1915.	Established during 1916.	Total.
Agusan		1	1
Albay	6	3	9
Ambos Camarines	19	3	22
Antique	1		1
Bataan	13	1	14
Bohol	6	2	8
Cagayan	14	7	21
Capiz	9	8	17
Cebu	3		3
Ilocos Norte	14	2	16
Ilocos Sur	29	2	31
Iloilo	4	2	6
Isabela	11	2	13
Laguna	10		10
La Union	9	1	10
Leyte	8	3	11
Mindanao and Sulu	2	1	3
Misamis	7	4	11
Mountain	5	2	7
Nueva Ecija	6	3	9
Occidental Negros	5	6	11
Oriental Negros	4	6	10
Pampanga	1	1	2
Pangasinan	25	2	27
Rizal	2	1	3
Samar	20	5	25
Sorsogon	9	1	10
Surigao		5	5
Tarlac	3	2	5
Tayabas	20	5	25
Zambales	14		14
Total	279	81	360

The principal benefit of communal forests is that each municipality will have a forest for its own use, even though the surrounding country has been lumbered or cleared off for agriculture. The scarcity of forests or their remoteness from centers of population in some parts of the Philippines show the advisability of establishing communal forests before all accessible timber has been removed.

CAIÑGINS.

The number of illegal caiñgins reported during 1916 as compared with 1915 shows a decrease of 353. This can be attributed to two causes, first, to the unusual number of showers in the dry season, which decreased the number of caiñgins made, and second, to the cumulative effect of talks by rangers on the evils of indiscriminate forest destruction and on the benefits of homesteading land.

Caiñgins reported during 1916.

Province.	Reported by—		Total.	Acted on—		Total.
	Forest officers.	Municipal presidents.		Convicted.	Acquitted.	
Agusan	1		1	1		1
Albay	6		6	1		1
Ambos Camarines	66	24	90	48	3	53
Antique	3		3			
Bataan	2		2			
Batanes						
Batangas						
Bohol						
Bulacan	2		2			
Cagayan	49		49			
Capiz	25		25	9	1	10
Cavite						
Cebu	41		41			
Ilocos Norte	1		1			
Ilocos Sur	2		2	1		1
Iloilo	2		2			
Isabela						
Laguna	1		1		1	1
La Union						
Leyte	210		210			
Mindoro	20		20			
Misamis	1		1			
Mindanao and Sulu	23		23	1		1
Mountain	1		1			
Occidental Negros	39	83	122	25	2	27
Oriental Negros	26		26			
Nueva Ecija	41		41	21	1	22
Nueva Vizcaya	1		1			
Palawan	7		7			
Pampanga	1		1			
Pangasinan	10		10		1	1
Rizal						
Samar	41	3	44	12	1	13
Sorsogon	35		35			
Surigao	11		11			
Tarlac	1		1			
Tayabas	66		66	52	7	59
Zambales						
Total	735	110	845	171	17	188

NOTE.—Information at hand shows that the total number of cases tried amounts to 525, but no reports are as yet received as to the decisions rendered.

Two definite changes in policy have been made, namely, to delegate the authority for granting caiñgin permits solely to rangers and secondly, to permit caiñgins freely in brush areas, provided the occupants agree to sow their areas with ipil-ipil when they abandon them.

Section 1011 of the Administrative Code empowers municipal presidents to act as Forest Officers only when specifically authorized to do so by the Director of Forestry. In accordance with this section the following letter was sent to all municipal presidents:

NOVEMBER 2, 1916.

CIRCULAR LETTER.

To all the municipal presidents:

As section 31 of Act No. 1148, generally known as the Forest Act, has been repealed, municipal presidents are no longer authorized to issue caiñgin permits. Section 1011 of the Administrative Code takes its place. This section reads as follows:

"Sec. 1011. *President of municipality to act in absence of local forest officer.*—In the absence of a local forest officer, the president of the municipality or settlement within which timber or other forest products are cut, collected, or disposed of, shall, when so instructed by the Director of Forestry, act in his stead for the performance of duties imposed upon such officer by or under the authority of this chapter."

Therefore, if you are not definitely authorized by the Director of Forestry to do so, you should not issue any more caiñgin permits.

You are, however, responsible for the maintenance and protection of the communal forest, if your town has one.

Any applications for caiñgin permits which you may have on hand may be used by residents of your town in making applications to the local forest officer.

ARTHUR F. FISCHER,
Acting-Director of Forestry.

A method of authorizing caiñgins in brush land with the proviso that the cleared land be planted to ipil-ipil before it is abandoned is being tried out on Mount Arayat. A number of caiñgin-makers were convicted for destroying brush and young trees on the slopes of Mount Arayat. The judge suspended the prison sentence of the caiñgin-makers with the understanding that the land would be reforested by them. On the date fixed by the judge, a ranger appeared and all the caiñgin-makers went with him to their clearings and sowed ipil-ipil seed, thus preventing the spread of cogon. The caiñgin makers themselves were so pleased with this arrangement that they secured permits to clear other tracts of brush land with the understanding that they were later to plant ipil-ipil seed. In this way landless settlers who are unable to take up homesteads may still cultivate a patch of ground and incidentally, by planting ipil-ipil, increase the local supply of firewood. As to whether this procedure can be extended to other parts of the Islands will depend upon the coöperation of the caiñgin-makers themselves.

FOREST DISTRICTS.

The following are extracts from the annual reports of the officers in charge of districts. The usual work common to all districts, and involving much time and travel, is scarcely referred to because the tables at the end of this report give a concise idea of the work done.

Before taking up the consideration of the district reports it may be well to explain the grouping of the provinces and Islands into districts. Contiguous provinces forming convenient administrative units are grouped into districts. The Visayas and southern Islands are grouped according to steamer routes.

DISTRICT NO. 1.—CAGAYAN AND ISABELA; HEADQUARTERS, APARRI.

In this district, as in almost all others, the high freight rates and scarcity of ships are blamed by small licensees for any decrease in their output. There probably has been a slight decrease in the amount of timber sent to Manila, but owing to a good tobacco crop the local demand for lumber has been excellent.

The number of timber licenses is greater by 26 than in 1915, the number now being 152, out of which number 43 of the smaller license areas were not inspected by a forest officer. There has been apparently a decrease in gratuitous licenses for personal use, but this is due to the fact that persons wanting timber for building tobacco houses now get a special license and not a gratuitous license as heretofore.

There has been no appreciable change in the number of firewood, rattan, and minor product licensees.

The number of parcels of public land inspected in accordance with the public land law shows a decrease. This scarcely means a decrease in distances traveled or expenses, as the homesteads were widely scattered. The number of parcels examined was 554 as compared with 692 in 1915 and 130 were on hand pending inspection as compared with 175 at the close of the previous year.

DISTRICT NO. 2.—NORTHWESTERN COAST OF LUZON; HEADQUARTERS, VIGAN.

There has been no increase in the number of timber licensees, but there has been more than the usual number of changes in the licensees themselves. This is accounted for by the fact that an individual wishing to build a house secures a license for timber and after cutting what he needs, does not secure a renewal. There were 143 timber licenses in force, 33 firewood, 18 limestone, 18 rattan, besides other licenses, making a total of 276 as compared with 250 for the previous year. Of the 143 timber licenses, 57 were operating on a scale large enough to warrant inspection by a ranger.

As for public lands, 376 parcels were examined and reported upon as compared with 268 in 1915. Owing to the receipt of many new requests for the examination of land in December, there are 88 cases still pending, which is practically the same number as a year ago.

The caiñgin situation is about as last year. Six caiñginmakers were successfully prosecuted and permits were issued to 62 others, not including those on approved homesteads. Owing to the scarcity of firewood and timber in parts of the district, several municipal presidents have agreed to the plan of the officer in charge of the district to plant ipil-ipil in waste land near the town and to restock the communal forests with desirable trees.

DISTRICT NO. 3.—BENGUET; HEADQUARTERS, BAGUIO.

There has been a decrease in the number of licenses issued both for timber and firewood, but this does not mean decreased activity for the remaining licensees. One sawmill closed down while the other increased its output. About two-thirds as much lumber was cut in 1916 as in 1915. The amount of firewood cut shows an increase of 50 per cent, as 15,700 cubic meters were invoiced in 1916. Both sawmill companies utilized logging waste for firewood with the result that there was an overabundance of fuel in Baguio. In addition to regular licenses for firewood, permits were given to Igorots and others to cut firewood or burn charcoal from stumps and wind-thrown trees. In this way, many otherwise inaccessible trees were utilized.

The forest officers assisted the city of Baguio in devising a fire protection system composed of lookouts and patrols for the prevention of grass fires within the city limits. The system has worked very satisfactorily, as was also the case with the forest patrols maintained elsewhere.

Mining in the vicinity of Baguio is being prosecuted with considerable energy. One company alone consumed 2,500 cubic meters of timber for mining purposes. Due to the scarcity of timber in the vicinity of certain mines, it was necessary for the Bureau of Forestry to take entire charge of all forests and allot the timber to actual users.

DISTRICT NO. 4.—NORTH CENTRAL PLAIN OF LUZON; HEADQUARTERS, DAGUPAN.

There has been a decrease in the amount of lumber cut locally due to two reasons. First, the competition of lumber from Manila and second, the scarcity of money due to a short rice crop. The chief demand for local timber is in the form of house posts. Several licensees were refused the renewal of their licenses because of their persistence in imposing upon forest users who wanted timber for personal use.

In 1916 there were 148 timber licensees, of whom 62 were inspected: the others, cutting only nominal amounts, were not inspected. This is an increase of 41 over the number issued in 1915.

Firewood licenses showed an increase of nine over those of the previous year, but there was a decrease of 35 in other minor forest product licenses.

Eight more public land reports were inspected during the year than in 1915, a total of 1964 being inspected out of 2,135 received. The remaining 171 reports will be inspected at the first opportunity.

The ranger who visited Nueva Vizcaya reported upon the firewood plantation started over a year ago at the Salinas Reservation near Bambang. The people evaporating salt at the salt spring need a great deal of firewood and to meet this demand the Bureau of Forestry furnished the official in charge with ipil-ipil seed to start a plantation. Unfortunately the deer, being very numerous near the salt spring, destroyed all the seedlings before they were half a meter high. Another attempt will be made to reforest this reservation, for without a convenient supply of fuel it will be very expensive to evaporate the water and make salt.

The number of caiñgins reported decreased from 66 to 38. This is due to two causes, namely, to the actual decrease in the number of illegal clearings in public forests attributed to talks on the subject by rangers and, secondly, to the fact that no caiñgins were reported unless sufficient evidence and reliable witnesses were available to secure a conviction of the offender:

DISTRICT NO. 5.—SOUTH CENTRAL LUZON; HEADQUARTERS, LOS BAÑOS.

During the year 162 timber licenses were in force, of which 88 were inspected. Those which were not inspected were small licensees who were not operating or had cut only a few meters. During the preceding year there were 277 licenses in force. Due to the competition of lumber from Manila, which can easily be shipped to all railroad and lake towns, the only local demand for timber was for dug-out canoes and houseposts.

A total of 150 minor product licenses were issued during the year, which is an increase of 46 over 1915. The greatest increase was in rattan, which was largely due to the opening of the railroad to Hondagua and the establishment of a regular boat service up the Tayabas coast. The number of firewood licensees has also increased considerably.

The number of homesteads inspected was 643, leaving a balance of 163 pending inspection. For the first time since the public land law was enacted there was a decrease in the number (57) of new homestead applications received in this district.

The caiñgin cases, as predicted a year ago, dropped in number, due to the publicity given to the law and regulations by rangers. During 1915, 84 cases were reported as against 37 this year. The amount of fines collected was three times as large as in 1915, amounting to ₱3,772. There are 29 cases awaiting trial.

The work of locating private holdings within the forest zones has continued through the year and when the cadastral surveys in the vicinity of Banahao are finished, it will be possible to establish a permanent forest reserve and throw open to homestead entry all public lands outside of the reserve.

DISTRICT NO. 6.—SOUTHERN LUZON; HEADQUARTERS, NAGA.

The typhoons of the preceding year naturally created a local demand for timber. Two mills shut down because of internal difficulties and not because of decrease in the demand for lumber.

There were 173 licenses in force during the year, of which 101, including all the important operators, were inspected. The number inspected during 1915 was 107 out of 145 licenses.

There was an increase in minor product licenses from 339 to 376, over-half being due to the increased demand for firewood.

The completion of the railroad from Manila to Calauag has resulted in a tremendous increase in the firewood, tie and pole industry in the vicinity of Calauag. Within a month after completion of the road all the available virgin mangrove swamps were occupied by licensees, who were busy selling material to the railroad or sending firewood to Manila. The mangrove swamp firewood from Calauag is now successfully competing with coal in the Manila market.

The number of parcels of public land inspected for homesteaders is 746, with 259 pending inspection, as compared with 516 inspected and 264 pending during the preceding year. The number pending is greater than it should be because of the absence of three rangers from the district for several months.

The number of caiñgin cases has decreased and out of 153 cases, 101 were convicted and 9 acquitted. The remainder are still pending trial.

The mines in the vicinity of Paracale show no decrease in the amount of timber used and fuel consumed.

DISTRICT NO. 7.—SOUTHERN VISAYAS AND ROMBLON; HEADQUARTERS, ILOILO.

The large lumber mills in this district had been forced by the war to develop local markets for their output, but this year their foreign and Manila contracts took so much of their output that their retail yards had to buy lumber in Mindanao to meet the local demands.

There were 218 timber licenses in force during the year. As usual, the larger operators received more attention than those who were cutting small amounts. Only one third of the total number of licensees were inspected, as the prevalence of cholera quarantines during the dry season hindered the work of the licensees and also of the rangers.

There has been an unprecedented demand for firewood. Rajas have been sold in some cases as high as ₱40 per thousand. The result has been a large increase in the number of firewood licensees, as well as an increase in the output. Apiapi, a despised cross-grained tidal swamp tree, is now being utilized and furnishes 80 per cent of the firewood sold in Iloilo.

During 1916, 227 firewood licenses were in force as compared with 149 in 1915. There was an increase in the number of licenses for rattan and other products, the total number being 688 for 1916, or an increase of 160.

The price of dyewood (Sibucao or Sapan wood) doubled and baling rattan sold for a time at ₱12 for a thousand pieces.

The frequent rains did much to decrease the number of illegal caiñgins and very probably the talks given by rangers have helped the people to realize the importance of protecting forests. In 1915, 247 cases were reported with 103 convictions. This year 112 cases were reported in which 22 convictions and one acquittal were obtained. No report has been received regarding the 89 pending cases.

The homestead work has increased, for 508 parcels were inspected and 117 were left pending as compared with 352 inspected and 198 pending in 1915.

DISTRICT NO. 8.—MINDANAO AND SULU; HEADQUARTERS, ZAMBOANGA.

The lumbering conditions in this district are much better than last year. The foreign demand for lumber, more especially in China, has kept some of the mills working overtime. In addition, there are more small licensees now than last year and fewer failed to operate. Two sawmills closed down for reasons not connected with trade conditions.

There were 158 timber licenses in force and 89 have been inspected. The previous year 117 licenses were in force and

101 inspected. The decrease in license inspection is due to the increase in land classification work.

There was also a slight increase in licenses for minor products, as 250 licenses were issued for various products during the year as compared with 231 licenses in 1915.

A new station was established at Butuan and the former station at Davao was reopened, with the result that a large amount of land classification work in connection with homesteads was finished.

The rangers have been very busy in explaining the Homestead Law to the more nomadic hill people in order that they may stop their shifting system of cultivation, which at present involves the annual destruction of many hectares of commercial forest. A liberal policy has been followed in dealing with these hill peoples and wherever possible permission has been extended to them to occupy brush land and noncommercial forest. The issuing of caiñgin permits by municipal presidents, while permitting farmers to clear land without delay, has resulted in the destruction of forested areas, due to the fact that the municipal officials were either unable or unwilling to inspect the land before issuing caiñgin permits. Some of this destruction may also have been due to the deliberate misstatements of applicants for caiñgin permits, who nominally applied for noncommercial forest and then used their permits as authority to destroy valuable timber.

During the year, 1,161 separate parcels of land were examined and 225 are still pending. Last year the figures were 860 for inspected parcels and 182 for pending parcels. In addition to these, several proposed colonies comprising 280 parcels were examined and certified as agricultural land.

The privately owned teak plantations which were established years ago by Moros are now being utilized. Unfortunately, severe grass fires running through the plantations while the trees were still young destroyed so many of them that those which were left developed short trunks and widespreading crowns, thus making many of the trees unsuitable for anything but ties and firewood. The Governor of Jolo is attempting to unite all private holdings in order that the plantations may be brought under scientific management and made to produce a larger percentage of saw timber.

DISTRICT NO. 9.—PALAWAN; HEADQUARTERS, PUERTO PRINCESA.

Lumbering in this district is governed solely by transportation facilities. Better freight rates and advantageous charters have induced Philippine ship owners to transfer their ships to other routes or to sell them outright. The *Panglima*, the only regular steamer to Palawan, was sold and the doubt as to the possibility of securing another boat, as well as the withdrawal of other ships, discouraged lumbering for a while. There were 43 timber licensees, which is six more than in the preceding year. There was an increase in tanbark, rattan, and resin licenses, 191 licenses for minor products being issued as compared with 132 in the preceding year.

DISTRICT NO. 10.—NORTHERN VISAYAS; HEADQUARTERS, TACLOBAN.

The local lumber market has been good. As fishing is an important industry, the demand for poles suitable for fish weirs is constant. The cutting of such poles is restricted to noncommercial species or to forests on land which is to be cleared for agriculture. There were 226 ordinary timber licenses as compared with 178 a year ago. Of these the number inspected is less than last year, being but 119; this is due to the resignation or departure from the district of three rangers and the detail of others with the Samar reconnaissance party.

There were 273 licenses for minor products as compared with 279 for the previous year. Several licenses for stone and earth were in force because of the demand for sand and gravel needed for the reconstruction of the warehouses destroyed by fire at Tacloban. The issuing of these licenses was a necessary administrative measure, as an attempt was being made to control the supply of gravel and sand, in order to get extortionate prices. By thus making available all sand and gravel deposits on public land, the rebuilding of the Tacloban water front with concrete warehouses was assured.

The shortage in personnel has also unfavorably affected homestead work. During the year 389 homesteads were inspected and 231 were pending at the end of the year, as compared with 405 inspected and 119 pending in 1915.

A vigorous campaign was made against persons destroying forests and 264 cases were reported to the provincial fiscals. Transfers of fiscals have delayed hearings on these cases. Earnest efforts have been made during the year to issue caiñgin permits only for the clearing of land applied for under the Public Land Act, as it is apparent that the cogon area in this district is increasing due to the shifting system of cultivation formerly in vogue in Samar and Leyte.

A beginning has been made in reforestation by distributing ipil-ipil seed, and recommending its use in the reforestation of nonagricultural land. Two of the large mines in the vicinity of Aroroy, Masbate Island, have nearly exhausted their supply of firewood and have installed oil burners rather than attempt to reforest with ipil-ipil the cogon hills in the immediate vicinity of their claims. Other miners, however, who were not in immediate need of firewood, are making provision for the future by planting ipil-ipil on waste land adjacent to their clams.

DISTRICT NO. 11.—CENTRAL LUZON; HEADQUARTERS, ORANI.

The Cadwallader-Gibson Lumber Company continues to supply the yards established in former years and as a result local licensees have been unable to sell anything but house posts (harigues) and dug-out canoes, as their hand-sawn lumber is unable to compete with the mill-sawn product. Another discouragement encountered by local licensees was the prevalence of rinderpest and the resultant quarantine of animals, which prevented the hauling of logs from the forest.

As could be expected, there has been no change in the number of timber licensees, as for years every available forest has been occupied. There has, however, been a slight increase in the number of firewood licensees and all are cutting increased amounts.

Efforts will be made to remedy the great scarcity of firewood in the sandy regions of southern Zambales through the coöperation of forest officers with municipal officials, who have requested that ipil-ipil be planted in the cogon hills and other waste land in the vicinity of their towns.

DISTRICT NO. 12.—MINDORO; HEADQUARTERS, CALAPAN.

There has not been much change in the logging conditions from those of last year. On the other hand, all mangrove swamps are occupied by firewood licensees and a number of applications have been received from persons eager to cut firewood, but for whom no areas have been located.

During the year 314 homesteads were inspected and 119 are awaiting examination. This is an increase of 57 over those of last year.

Caiñgin control is the most difficult problem of the district, for not only must the nomadic hill people be considered, but also colonists from Luzon and the Visayas. These settlers are homesteading land and in several cases they have pulled up their corner stakes and relocated them inside dense commercial forests.

The effort to prevent further destruction of forests in the western part of Mindoro has met with considerable opposition because of the peculiar system of land tenure there. Any land which has been cleared or claimed by a person is considered as his private property and is sold or inherited, even though no tax has been paid on the land and no crops have been planted for years. The same is true of forested land, with the result that the rangers in attempting to prevent the destruction of forests are compelled to overcome imaginary claims and have to meet the hostility of the entire population, who believe that the rangers are infringing upon the rights of the people. It is still too early to say whether the talks given by rangers on this subject will have any beneficial effect.

DIVISION OF INVESTIGATION.

It has been the policy of the Bureau of Forestry to have the members of the division of investigation give the instruction in the Forest School. The offices of the division have been at Los Baños. This arrangement has provided a faculty for the school and has made it possible to do a much greater amount of investigative work than would have been possible otherwise. It has been realized that satisfactory instruction could not be given unless the instructors were actively engaged in investigative work and that the inspiration of teaching would impel the investigator to do his best work. The division has been hampered by lack of sufficient personnel; but there has, nevertheless, been a good deal accomplished.

PERSONNEL.

The personnel of the division consists of one wood technologist as chief, one instructor in forestry, one forester, six rangers, one nurseryman, two stenographers, and a varying number of temporary employees.

The forester in charge of district 5 acts as instructor in administration in the forest School and coöperates with the Division in the use of the Mount Maquiling Forest Reserve for investigation and instruction purposes.

The following are some of the more noteworthy features of the year's work:

RECONNAISSANCE.

A review was prepared of all the reconnaissance projects which have been completed by the Bureau since its organization, and recommendations were made for the standardization and improvement of future reconnaissance work.

The class in Forest Engineering II did its work this year on the Cambontoc Block of the Mount Maquiling Forest Reserve. The work was similar to that done on the Batangas and Calamba Estate Blocks during the two preceding years. This work added a great deal of valuable information in the way of stand tables, composition studies and topographic data. It supplied the information needed to complete the forest map of the Mount Maquiling Forest Reserve.

DETAILED COMPOSITION STUDIES.

The Dendrology class each year makes a very detailed study of one square kilometer on Mount Maquiling, taking a census of all the woody plants on the area. In 1913 the class work was done on kilometer 1; in 1914, on kilometer 7; in 1915, on kilometer 12. This year the work was done on kilometer 8. This work has helped greatly in our understanding of the composition of the forest, as well as being of great instructional value to the class. Besides this, each class has some work of this kind on the summer instruction trip.

INVESTIGATION OF FOREST PROBLEMS.

DENDROLOGY.

Flora of the Mount Maquiling region.—The work on this has gone forward in connection with the dendrology class work. The outlines prepared for the dendrology course constitute a preliminary manual of the Mount Maquiling Flora. It is expected that each year will see a continuation and revision of this work until it is sufficiently complete for publication by the Bureau. At the present time there are known 1,830 species of flowering plants and ferns in the Maquiling flora. Of these 613 are trees; 155, shrubs; 228, vines; and 732, herbs. It is interesting to note in this connection that, when "Important Philippine Woods" was published, in 1901, but 665 tree species were known from the entire Archipelago.

Check list of woody plants of the Philippines.—The work on this has been kept up to date, so far as publications available are concerned. At the present time the check list deals with 4,710 species. Of these 2,500 are trees; 1,394, shrubs; and 816, vines.

Rattan.—Up to the present, probably not more than one-fourth of the rattans reported as occurring in the Archipelago have been more or less certainly identified. The further identification of as yet unknown or little known species will be continued as rapidly as new material is discovered.

Rubber.—Wild rubber is at present of exceedingly little importance in the Philippines. Representatives of different rubber companies have indicated that they believe it possible to work some of our wild rubbers at a profit. A study is under way of the different wild rubber plants. As soon as it is possible to definitely identify them, samples of wild rubber will be collected and submitted to commercial firms for valuation.

Bamboo.—Growth measurements of the principal local bamboos have been made each year since 1911. A fine collection of different kinds of bamboo has been started. There are at present about 20 species growing in the collection. Studies of the yield and manner of growth of the caña boho in Bataan have also been made this year.

SILVICULTURE.

Growth studies.—The growth measurements of about 600 forest trees have been continued in the same method as in previous years.

Besides this, a much more extensive series of measurements have been made in the nurseries and plantations, which give the average growth of many of our timber trees, under certain conditions of managment.

Silvical notes.—Since 1914 the classes in Silviculture II and Silviculture III have done a good deal of work in the preparation of silvical leaflets. This has added decidedly to our knowledge of the conditions under which many species are found and the characteristics of these species. Up to this time there have been something more than 100 species treated in this work.

Reproduction studies.—Permanent reproduction plots were laid out in cut-over forests in Bataan Province in 1913. These have been examined semiannually since that time. Many very interesting details have been observed in the study of these plots; but it is not yet safe to attempt any generalization as a result of this work. The number of reproduction plots should be increased.

Planting.—Thus far, more than 600 species have been handled in the nurseries or plantations. A few of these, namely, ipil-ipil, lumbang, bagilumbang, molave, lanutan, narra, calantas, teak, and *Swietenia macrophylla,* have shown promise as plantation crops. These are being planted on a more extensive scale.

During 1916 forest plantations of the dipterocarps and rattans have been started. These forms have not shown success when planted in the open. It is expected that gutta-percha and other forest forms will be similarly planted whenever material is available.

The permanent plantations have been extended this year by 7½ hectares of new planting.

Twenty-nine hectares of cogon land in the neigborhood of the Forest School have been planted up, principally with ipil-ipil, this year. This planting is doing very well thus far, and will be permanently successful if cogon fires can be kept out for one year.

Seed Collection.—The museum collection of seeds now contains material of 543 species. This collection is very useful in connection with the class work in silviculture.

In connection with the course in silviculture in the Forest School, several special studies have been made. These have included the study of the root development of 224 species of trees, experiments with cuttings of 104 species, and experiments with forest grown seedlings of 34 species.

FOREST ENGINEERING.

Trail work on Mount Maquiling.—No extensive new trail work was done during the year, because of lack of funds; but a small section of new trail was constructed as a part of the class work in Forest Engineering III.

DURABILITY TESTS.

These tests have now continued for a number of years, and the information accumulated is of great value. It is hoped that it can be worked up for publication in the near future.

FOREST SCHOOL.

The school work of the year has been marked by the separation of the School from the College of Agriculture, the occupancy of the new Forest School building and by certain changes in personnel.

The health of students has been good throughout the year. The registration of the school has been 21 seniors and 24 juniors. These represent the following provinces: Cagayan, Ilocos Norte, Nueva Vizcaya, Tarlac, Ilocos Sur, Pangasinan, Pampanga, Bulacan, Rizal, Batangas, Tayabas, Camarines, Cebu, Iloilo, Capiz, Negros Oriental, Negros Occidental, Bataan, La Union, Zambales, Manila. Twenty-four students were given certificates in March, 1916, upon the completion of the ranger course. Nineteen of these were employed as rangers in the Bureau of Forestry with salaries ranging from ₱50 to ₱60 per month. Five private students were given certificates; three of these were from China and two from Guam. There is one private student from China in the junior class this year.

The course leading to a degree has not been given during the present year, but it is practically assured that it will be offered during the coming year.

EQUIPMENT.

The new Forest School building was completed in December, 1916. The cottages were partially completed during 1916, but work had to be stopped at the end of the year for lack of funds. There has, this year, been appropriated a sum for the completion of the cottages and the construction of a mess hall and road. It is hoped that these will be completed before the beginning of the next school year in June.

VACATION WORK AND PRACTICE TRIP.

During April and May, 1916, the present senior class camped in that part of the Mount Maquiling Forest Reserve known as the Cambontoc Block, and finished the work necessary to the completion of an adequate topographic map of the mountain. During October and November, the senior class was taken to the cutting area of the Cadwallader-Gibson Lumber Company in Limay, Bataan, for instruction in logging and milling. Following this trip they spent three days in Manila, studying the different wood using industries and the collection of wood samples at the offices of the Bureau of Forestry.

REFORESTATION.

Reforestation in the Philippines is of paramount importance when one considers that over 40 per cent of the area of the Islands is covered with cogon grass (*Imperata exaltata*) which is useless for grazing, is a fire menace, destroys the productivity of the soil in which it grows, and, worst of all, is the breeding place of the locusts which yearly swarm over the Islands and damage crops to such an extent that the Government is compelled to spend great sums of money in trying to exterminate them. The cogon area is gradually increasing, due to the caiñgin system, and unless steps are taken to reclaim a part of this vast area yearly, it is doubtful whether any permanent progress can ever be made in the control of the locust pest.

A tree, ipil-ipil (*Leucaena glauca*), has been found which will kill out cogon grass within two years. No preparation is necessary other than burning the cogon just before the rainy season and broadcasting the seeds. The value of the trunk for firewood, the foliage for green manure, the seeds as a substitute for coffee, and, what is more important, the power of fixation of nitrogen in the soil and of remedying the toxic effects produced by cogon, commend this species above all others. The Bureau of Forestry has been principally interested in ipil-ipil for reforestation and has distributed seed through the rangers and coöperated with other Bureaus in its dissemination. Wide publicity is given and the effect is beginning to be noticed. Several municipalities have begun the reforestation of the waste cogon lands in their vicinity and private individuals have planted ipil-ipil on their cogon lands and are cutting on a one or two year rotation for firewood.

Thirty hectares on the Maquiling Forest Reserve, as well as 15 hectares on the Calamba Estate Addition to the reserve, have been reforested by the division of investigation, principally with ipil-ipil.

This year the Bureau has been in a position to attempt reforestation on a much more extensive scale, due to the special appropriation of ₱10,000 for the purpose, with the proviso that the Government friar estates having denuded non-agricultural land be reforested. The Talisay-Minglanilla Estate on the Island of Cebu was selected and the entire work confined to that, as it is located on one of the larger denuded Islands and will serve as an object lesson. The following is a short abstract of the work performed and the results obtained since the inception of the project in June, 1916.

LOCATION AND AREA.

The portion of the Talisay-Minglanilla Estate under the administration of the Bureau of Forestry lies about 3.2 kilometers N 10° E and 4.6 kilometers N 40° W from Minglanilla and Talisay, respectively. It contains about 4,095 hectares.

SOIL AND TOPOGRAPHY.

The area in general is mountainous with steep slopes. Rocks and stones are very prominent, especially in old caiñgins. In the upper part, which is not so thickly settled, the soil is loamy clay.

DRAINAGE.

The area is drained largely by Mananga River on the east, by Pingan River and Cuanos-Paquigne in the middle and by Inayagan River on the west. These usually dry out during the hot months, or have but very little water. The river beds are broken up by falls from 2 to about 15 meters in height.

BOUNDARY.

The length of cleared boundary lines is 17.2 kilometers, 14.1 kilometers of which were planted with ipil-ipil seedlings and kapok seeds. Very rocky parts were broadcasted with ipil-ipil seeds, besides being planted with seedlings to assure good results. The total number of seedlings planted was 30,230.

PLANTING.

Cógon burning.—After locating, cleaning and planting the boundaries, the cogon areas in blocks Mananga-Bulacao, Mananga-Pingan, and Pingan-Mangilamon were burned to prepare the ground for broadcasting with ipil-ipil seed.

Purchase of seeds.—Bagilumbang and ipil-ipil seeds were bought in the province of Cebu at ₱0.30 per thousand and ₱0.07 to ₱0.25 per ganta, respectively. (One ganta=3 liters.)

Labor.—The labor hire in the locality was ₱0.40 a day of nine hours. Five of the best men, who served as capatazes (foremen) were raised to ₱0.60.

Species planted.—The species planted were Lumbang (*Aleurites moluccana*), Bagilumbang (*A. trisperma*), and ipil-ipil (*Leucaena glauca*).

Methods used for planting.—The cheapest methods of planting were adopted, to lessen the cost of labor, which was very high because of the rough terrain.

Lumbang (*Aleurites moluccana*).—The seeds were treated by the "burning method" and sown directly in caiñgins. The distance between rows was 3 meters and between seeds, ½ meter.

Ipil-ipil (*Leucaena glauca*).—The cogon areas along roads were planted with ipil-ipil seedlings by means of sharp pointed dibbles. Plants were set 2 meters apart.

In burned cogon areas, seed was broadcasted at the rate of 24 liters per hectare.

TRAIL WORK.

Two trails were made: a "horse trail" (joining the Mananga River to Maghawa) and a "foot trail" (joining the Mananga River to Mount Akan.) They are 0.915 and 3.114 kilometers long, and cost ₱43 and ₱71.70, respectively.

SUMMARY OF PLANTATION IN GENERAL.

Total area under administration of Bureau of Forestry	hectares	4,095
Total area planted (approximate)	do	666
Per cent of area planted		16.26
Total amount of Ipil-ipil seeds planted	liters	9,342
Total number of Ipil-ipil seedlings planted		74,611
Total number of Bagilumbang seeds planted		163,930
Total distance of boundary cleaned	kilometers	17.2
Total distance of boundary line planted	do	14.1
Total distance of horse trail constructed	do	0.915
Total distance of foot trail constructed	do	3.114

DISCUSSION OF BLOCKS.

A. MANANGA-BULACAO BLOCK.

There are a few squatters living on the place. The land is almost all claimed by one person, Marcelo Adalo, who has his house inside the area.

The vegetation of the block is shown by the following estimates:

Total caiñgins	hectares	64
Caiñgins planted	do	37
Total cogon area planted	do	50
Second growth	do	115
Total	do	229

Planting ipil-ipil seeds.—Broadcasting: An area of about 50 hectares was broadcasted with ipil-ipil seed at the rate of 24 liters per hectare. The total amount of seed broadcasted in the block was 3,009 liters, of which 1,206 liters was used filling in blanks and 1,803 liters in broadcasting the burned cogon areas.

The average cost of broadcasting one hectare of burned cogon is about ₱0.28.

Results of ipil-ipil broadcasting.—Of the 475 ipil-ipil seedlings measured, the average height (on January 10, 1917) was 17 centimeters. The estimated number of living seedlings is 39,583,300. From these figures the average per cent of germination is 58.1.

Seedlings.—The cogon areas in the block facing the road were planted with ipil-ipil seedlings, besides being broadcasted, to insure exterminating the cogon in a short time. In this block, 60,770 seedlings were planted. Many of the plants sent out sprouts and in some places they are now crowding the cogon.

The average cost of collecting and transporting 1,000 seedlings was ₱0.93 and of planting, ₱2. The cost per M would have been lower but for the configuration of the ground and the distance from which the seedlings were obtained.

Bagilumbang planting.—In 78 caiñgins along the roads, 152,930 bagilumbang seeds were sown, in rows 3 meters apart, and 50 centimeters between seeds in the row.

Results of bagilumbang.—Of 336 bagilumbang seedlings measured the average height was 40.84 centimeters, January 19, 1917.

The total number of plants living in 500 square meters is 336.

B. MANANGA-PINGAN BLOCK.

The soil is very poor and rocky. Water supply in this locality is obtained from either Mananga or Pingan River.

The block contains the following types of vegetation:

Total caiñgins (approximate)	hectares	60
Total caiñgins planted	do	15
Cogon with brush	do	100
Shrubs and second growth	do	51
Total	do	211

Planting ipil-ipil seed.—Broadcasting: The total amount of seed broadcasted was 2,166 liters. The average cost of broadcasting one hectare was ₱0.28.

Results of ipil-ipil broadcasting.—The total number of seedlings in 5 square meters is 288; therefore, the approximate number of plants per hectare is 576,000. The average height of the seedlings on January 19, 1917, was 15 centimeters.

Bagilumbang and lumbang planting.—Only 2 hectares were planted with bagilumbang seeds in the interior of the block. All the caiñgins facing the road were planted with lumbang and bagilumbang. The total number of bagilumbang seeds planted was 11,000, of lumbang, 52,920, in 28 caiñgins.

Results of lumbang planting.—The total number of plants living in 0.14 hectare is 230, with an average height of 47 centimeters. The number of plants living in a hectare is then about 1,650. The number of living lumbang plants in the block is 21,450. The per cent of success is 40.53.

C. PINGAN-MANGILAMON BLOCK.

The Pingan-Mangilamon Block lies between the upper portion of Pingan and Mangilamon Rivers as far as Monument No. P., containing an area of 266 hectares.

The soil is loamy clay, but in places where caiñgins are old, it is very rocky.

Planting.—This block was the last one planted, burned cogon being broadcasted with ipil-ipil seed amounting to 4,467 liters.

Results of ipil-ipil broadcasting.—The number of seedlings living in 5 square meters is 283, with an average height of 11 centimeters. The estimated number of seedlings per hectare is 566,000.

INDICATED FUTURE WORK FOR THE YEAR 1917.

Broadcasting seed.—It is planned to broadcast all the cogon areas above Mangilamon River beginning from the Mananga River, following the Cebu-Toledo Road as far as Camp No. 7.

Bagilumbang planting.—All poor caiñgins inside the Mananga-Bulacao and Mananga-Pingan Blocks and the caiñgins along the road in Pingan-Mangilamon Block will be planted with bagilumbang seeds.

Stock in the nursery.—The stock in the nursery will be planted in richer caiñgins in the upper part of the estate.

DIVISION OF FOREST MANAGEMENT.

This division was organized at the beginning of 1915 for the purpose of administering the long term timber licenses, generally known as concessions, and the larger annual licenses for sawmills, granted by the Bureau of Forestry, and for fostering a better understanding between the Director of Forestry and the lumbering interests of the Islands. The policy governing this work during 1916 has been along the same general lines as for the previous year, with such minor changes as experience has shown would work to the mutual benefit of the Government and the lumber industry.

In the administration of the large cutting areas the main objects have been: to determine the correct amount of timber cut by each licensee by scaling the logs, which is the basis for the assessment of forestry charges; to encourage the closest possible utilization of the merchantable timber; to keep the Director of Forestry informed as to the general conditions of the lumber industry; and to propose and enforce such regulations as will assure the natural reforestation of cut-over forest land. The pursuance of this work has demanded that selected rangers be stationed at each of the sawmills and that their work be inspected as frequently as possible by experienced men. One man has been constantly employed throughout the year, not only in checking the log scale, but in assisting the scalers in making mill studies and in conducting practical demonstrations in the woods and mills in order that the rangers should obtain a broader understanding of their duties. The greater part of the men chosen for this division, after two years of training, are handling the work with a great deal of credit to themselves and to the Bureau and in time promise to be valuable men in the lumbering industry, but a considerable percentage of them, although efficient in other phases of forest work, were found unfit for these particular duties.

The unanimous protest of the Philippine lumbermen relative to the log scaling law which went into effect on July 29, 1915, has gradually abated. Some of them still object on the ground that the prices charged for timber by the Government are excessive, but in general there is little complaint and all of them freely admit a decided increase in the ability of the scalers during the past two years. The policy of establishing forest stations at each of the mills and having a Bureau representative constantly on hand for the purpose of carrying on the concession and license administration, and the frequent inspections by men from the head office have done a great deal to bring about a better understanding between the Bureau and the lumbermen; and it is sincerely hoped and expected that, as our men become more familiar with the practical side of the lumbering operations, they will be of actual assistance to the operators as well as to the Government.

The personnel of this division consists of a forester as chief with headquarters in Manila, two American field assistants and fifteen rangers, all of whom are called upon to do more or less work in other divisions.

LUMBER INDUSTRY.

The Philippine lumber industry for 1916, as compared with the two previous years, has enjoyed a certain degree of prosperity which at this time sees nearly all of the mills running successfully and not a few preparing to increase their output by working double shifts or by the installation of additional machinery. This optimism and renewed activity are due to a great extent to favorable prospects for the immediate future, based on the increase in sales and the unprecedented demand for Philippine lumber, particularly in the Far East. The first year after the beginning of the European war saw the lumber business badly disrupted and it was well into the second year before a readjustment of conditions began to make it possible for the mills to operate even at a very small margin of profit.

Immediately after the beginning of the war there was but little demand for lumber and, as the dealers had a large supply on hand, the prices very naturally dropped far below normal while freight rates advanced to prohibitive figures for such commodities as lumber. Then too, there was a considerable rise in the prices of logging and milling supplies and equipment, which necessarily increased the cost of production. This factor alone would have seriously retarded the industry even under normal conditions; the final result being that many of the mills were forced to close down and those that continued to operate, with a very few exceptional cases, did so at a loss.

The universal shortage of freight space was, and is now, more keenly felt on the Atlantic than on the Pacific, and in turn, freight across the Pacific is more difficult to obtain than between Far Eastern ports with rates respectively higher, which with other conditions is working to the advantage of the Philippine lumber business. Shortly after the first of the year, the law of supply and demand began to assert itself and the one condition, that of unusually high freight rates, which more than all others had previously caused the depression, is now having an exactly opposite effect. Prohibitive Atlantic freight charges had caused a temporary shortage of African, Cuban, and Honduras mahogany in the United States and this afforded an excellent opportunity for the introduction of certain grades of Philippine lumber. Trans-Pacific freight space was high but still obtainable and the increased price received for our lumber made it possible to ship it at a profit.

The amount of sawn lumber and timbers shipped to the United States for 1916 is 14,880 cubic meters, or roughly 6,309,000 board feet, having a declared valuation of ₱659,186 as compared with 10,451 cubic meters or 4,432,000 board feet valued at ₱469,785 for 1915. All of the shipments have proven very satisfactory and the indications are that a permanent market has been established for certain species of our woods. While exceedingly high freight rates have been paid on these shipments, the price received has more than counterbalanced them and the fact that bottoms were procurable even at greatly advanced figures proved to be a big advantage over the Mexican and African lumbermen, who were unable to obtain shipping space at any price.

Perhaps the greatest advantage achieved by the industry during the year is that the prevailing conditions made it possible for us to demonstrate our ability to supply the demand and to show with what quality of lumber that demand would be supplied. Our export shipments as compared with other timber producing countries have been few and small, but they have consisted of many species and grades which have reached a variety of markets where they have invited more or less favorable publicity amongst lumber dealers, with the result that at the present time the mills have more orders than they can fill, many of the orders being from New Zealand, Australia, India, and China, and for widely varying requirements. The principal demand, however, from these countries, excepting China, has been for railroad ties and squared logs, but of these very few have been shipped.

At the close of this year practically all of the mills are running and the prospects for 1917 are good. Many applications for timber licenses and inquiries concerning timber supply are being received by the Bureau and the indications are that there will be several additional mills operating in the Islands before the close of the year 1917.

THE CHINA MARKETS.

The unusual opportunity afforded for the extension of the Philippine lumber business in the United States, caused by the universal chaotic shipping conditions, is still present, and to an even greater extent, in the Hongkong and China markets. Because of trans-Pacific freights being scarcer and correspondingly higher than between Far Eastern ports, the large quantity of lumber from British Columbia and the Northwestern United

States which formerly went to China is now being replaced by our woods. Some of the Philippine mills are running almost exclusively on orders from China and practically all of them have booked some orders from firms in that country. New markets have been found in this field for Philippine woods in the form of barrel staves and box shooks, which would probably never have developed had shipping conditions been normal, but now, since these products have been introduced, it can be expected that by the time conditions are again settled they will have gained a sufficiently firm footing to at least survive on a competitive basis.

The amount of Philippine timber and lumber exported to Hongkong and China for the year 1916 as shown by the records of the Bureau of Customs is as follows:

	Cubic meters.	Board feet.	Value.
To China:			
Timber	190	80,560	₱9,484
Lumber	15,270	6,474,480	254,828
Total to China	15,294	6,555,040	264,312
To Hongkong:			
Timber	413	175,112	6,474
Lumber	9,255	3,924,120	92,949
Total to Hongkong	9,668	4,099,232	99,423
Total timber and lumber to Hongkong and China	24,962	10,654,272	363,735

Comparative figures for previous years are not available, but it is known that the lumber trade with China and Hongkong for 1916 nearly trebled that of 1915 and that there has been a marked advance in prices for Philippine lumber during that period.

The following is an extract from the report of the chief of the division of forest management, L. R. Stadtmiller, on the conditions of the China lumber market, which was investigated by him while on vacation during the latter part of 1916:

> The Hongkong market differs from the rest of the China coast markets in that it will take many grades of all species of lumber, provided that these can be gotten down to a price which will allow their successfully competing with the Borneo woods. At the present time the market in Hongkong demands mostly logs and those of the lauans, apitong, guijo and yacal. Competition with the Borneo woods is very strong in that they sell for slightly less than the Philippine woods can be placed on this market. This, however, would not defeat the development of our lumber trade in China, as the Chinese have a preference for Philippine lumber.
>
> At present the market demands timber mostly in the form of logs, but it is believed here also that if correctly handled the trade can gradually be broken in to take the manufactured lumber.

Throughout the rest of China, that is from Hongkong north, the market was found to differ from that of Hongkong in that practically the only use for which Philippine woods can be introduced is for interior trim, floors, etc. The middle and northern markets of China are supplied with fir and pine at a cheaper price than Philippine woods can ever be put in these markets and therefore fir and pine lumber will always hold first place for the cheaper construction woods and for woods of which seasoned material of long dimensions is demanded. In spite of the fact that it appears that Philippine woods only have a future for interior trim, etc., it is believed that the market for this purpose is practically an unlimited one, as China itself has, comparatively speaking, no hardwoods of its own. Added to this is the fact that the Chinese people have a natural love for hardwoods which they use in their houses and in making their furniture.

As an indication of the possibilities of the China lumber market, figures are submitted, obtained from the consul general at Shanghai, as to the quantity of wood imported into China and Shanghai:

Imported into all China.

	1913		1914		1915	
	Board feet.	Value.	Board feet.	Value.	Board feet.	Value.
Softwoods	159,602,884	$2,878,819	204,075,845	$3,260,201	88,372,228	$1,525,948
Hardwoods	31,928,184	795,693	42,784,872	1,017,023	25,507,848	583,710
Total	191,531,068	3,674,512	246,860,717	4,277,223	113,880,076	2,109,658

Imported into Shanghai alone.

	1914		1915	
	Board feet.	Value.	Board feet.	Value.
Softwoods	98,011,090	$1,575,724	56,437,872	$956,515
Hardwoods	16,989,984	395,866	8,429,748	177,204
Teak	1,139,052	88,859	1,715,004	110,121
Total	116,140,126	2,060,449	66,582,624	1,243,840

It will be readily seen that 1914 was the banner year, when the imports of softwoods were some 200,000,000 feet, of which 40 to 50 per cent came from the United States, the remainder coming mostly from Japan. In 1915 this importation fell to 88,000,000 feet, due almost wholly to the jump in freight rates after the war started.

LOCAL MARKET.

Although the consumption of lumber in the Islands for the past year has been about normal, there has been a decided change in the source of supply, which has materially assisted the Philippine lumber industry. The large quantity of Oregon pine previously brought into this country and sold at comparatively low prices has within the last year been entirely replaced by native lumber. A second contract for native timber awarded by the United States Army Quartermaster's Corps for 1916 speaks well for its quality and excellence of manufacture. In 1915 that department purchased approximately three and one-half million feet of Philippine lumber and this year nearly the entire United States Army requirements for the Philippine Department, about six million board feet, has been contracted for with local mills. The unusually large amount of lumber shipped to the States and China has greatly stimulated the local market in that the yards have not been overstocked, as they have previously been, and prices have advanced to a point where lumber can be readily sold at a profit. The amount of lumber used in the Philippine Islands during 1916 is between thirty and thirty-five million board feet, which is a slight increase over the two previous years.

GRADING RULES.

It is to be regretted that the increased activity of the lumber industry has not brought about some progress in the matter of grading rules for Philippine lumber. Rules were adopted by the National Hardwood Lumber Association of the United States for certain species of this lumber going to America, but they are far from being practicable and it is doubtful if they will ever be employed. Most of the lumber going to that market is sold under the "mahogany" rules of the association, which are more applicable to Philippine lumber than any others yet formulated. The only rules existing for Philippine lumber, aside from the above mentioned, are those proposed by the Bureau of Forestry several years ago, which in themselves do not completely or adequately cover local conditions, and were intended only as a basis from which feasible rules could be developed by the manufacturers. In the absence of other rules, however, they are employed in the purchase of all native lumber used by the Army, Navy, and Insular Governments, which amounts to approximately one-fourth of our total lumber production. It is the opinion of the Bureau of Forestry that there is no action within the power of the Philippine lumbermen that would aid their business to such an extent as a lumberman's association which would formulate and adopt practicable grading rules and compel its members to adhere to them. The rules adopted by the National Hardwood Lumber Association for Philippine lauans are merely the rules for African and Mexican mahogany, slightly changed, with the obvious purpose of admitting a poorer quality of our lumber than is expected of the above-mentioned species. We feel that our lumber is not inferior and while some localities produce a large percentage of low grades, by far the larger amount is exceedingly high grade and needs no favoritism. The rules in question are unanimously condemned by the Philippine lumbermen and it is a certainty that very little lumber will ever be sold under them.

The main exceptions taken by this Bureau to the rules are in regard to the admission of pinholes, sap, and of light and inferior lumber in the higher grades. To discuss these in the order mentioned: The rules state, "Pinworm holes not to be considered a defect in any of the grades, excepting boards showing pinworm holes, in the rough, following and tracking with the face." A large quantity of lumber is produced in this country that is reduced to a grade below common because it is perforated with pinholes and still does not show them "in the rough, following and tracking with the face." Boards that could not be used even for rough construction because of wormholes, could, under the rules for "Philippine mahogany," be classed as firsts and seconds.

Regarding sap, the rules for African and Mexican mahogany admit one inch of sap in the aggregate, but it is a fact that our larger exporters do not include it in the higher grades because of its distinctly inferior quality, although the lumber sold under the National Hardwood Lumber Association rules would admit it as a standard defect. The lumbermen feel that they would prefer to keep the grade and price up and establish a reputation for their product as a first-class article rather than drop to a lower basis by admitting pinholes and sapwood.

Lauans and tanguile from many parts of the Islands are practically free from pinholes and it would be an injustice for such lumber to compete under rules that admit pinholes in lumber so long as they do not appear parallel with the face of the boards. Furthermore, it would be very difficult to purchase lumber under these rules. A buyer in the States ordering lumber from here would have a very indefinite idea as to what he would receive. He might receive a cargo of exceptionally fine tanguile or red lauan, absolutely free from pinholes and he might obtain a shipment containing 30 to 40 per cent light colored, wormy and less valuable lumber.

The Philippine lumbermen who have been affected by them think that the rules are impracticable as the National Hardwood Lumber Association inspectors may be compelled to inspect in accordance with the rules governing the grade of "Philippine mahogany," and they are making an effort to prevent this by specifying in the sale agreement that the timber be graded according to African and Mexican mahogany rules.

OPPORTUNITIES FOR LUMBER SCHOONERS.

That the Philippine Islands offers an attractive field for the operation of several "auxiliary" lumber schooners with a carrying capacity of from two hundred and fifty thousand to three hundred and fifty thousand feet is indicated by the prevailing freight rates on lumber between Philippine ports, and the large amount of business that could be had in this particular line. For the past two years there have been considerable quantities of lumber at practically all of the mills which could not be sold because of the impossibility of obtaining boats to carry it to the market. A few small boats that make a practice of carrying lumber are proving to be good investments and as the amount of lumber awaiting shipment greatly exceeds their carrying capacity, it is only natural that they operate in but a short radius from Manila, thus leaving the more isolated mills to market their product as best they can. The larger inter-island boats are not equipped for carrying lumber and it is difficult to induce them to receive even small shipments at exhorbitant rates. The freight rate on lumber for the past year between Mindanao points and Manila is more than between Mindanao and Hongkong, and even Shanghai, which is explained by the fact that shipments to foreign ports are carried in foreign bottoms while the interisland cargos are confined to local boats. This peculiar condition is directly responsible for the large decrease in lumber shipments from Mindanao to Manila which, in turn, has resulted in an increased price of lumber to the Manila consumer without materially advancing the price to the Mindanao mill men.

The wooden-deep-sea lumber schooners with internal combustion engines have proven a success along the Northwest coast and there is no apparent reason why they would not be equally successful here. The first cost of these vessels, as well as their maintenance and operating cost, is comparatively small and their carrying capacity and range of adaptability are large. The lumber production of Mindanao at the present time justifies the construction of two or more vessels of this type with a capacity of 200 M to 250 M feet and the market that could be developed for lumber and logs in China, India, and Australia is far in excess of anything yet accomplished in the Philippine lumber industry. During the past year many orders have been received from Australia and India for logs, squared timbers and flitches which could not be accepted because of the lack of transportation. Conditions at this time are very favorable for the development of the log and timber business, particularly in Australia, and the construction of boats capable of handling this trade in conjunction with the general inter-island lumber transportation suggests itself as an attractive business proposition.

COMPARATIVE FOREST CHARGES.

During the past two years there has been considerable dissatisfaction among the lumbermen in regard to the assessment of forestry charges. Act No. 2451, passed by the third session of the Philippine Legislature, which went into effect on July 29, 1915, states that all timber cut in public forests shall be measured in the round before it is sawed and that a reasonable deduction shall be made for natural defects by authorized scalers. As no other than metric units of measurement are recognized by the laws of the Philippine Islands, it is necessary that the contents of logs be determined in cubic meters or fractions thereof; and while it was not the intent or purpose of the law to increase forestry charges, its enforcement has, nevertheless, resulted in an increase of from 20 to 30 per cent over those received under the previous method of collection. As practically all of the Philippine lumber industry is conducted on the basis of the English "board foot" as the unit of measurement, it is only to be expected that considerable confusion and dissatisfaction results in the association of the production of the mills in board feet with the log scale in cubic meters, which represents the solid merchantable contents of the logs including the unavoidable waste in the form of slabs, sawdust, and trimmings. The following table is presented to show the forestry charge per cubic meter, log scale, per group, and the corresponding resultant charge per one thousand board feet actually paid on manufactured lumber, depending on the amount of merchantable timber wasted in sawing; or in other words, upon the closeness of utilization:

Comparison of forestry charges, cubic meters, log scale as against actual board feet produced in mills.

Charges per cubic meter.	Charges per M board feet depending on the percentages of utilization.			
	60 per cent.	65 per cent.	70 per cent.	75 per cent.
Fourth group, ₱0.50	₱1.97	₱1.81	₱1.69	₱1.57
Third group, ₱1.00	3.94	3.62	3.37	3.14
Second group, ₱1.50	5.90	5.43	5.05	4.71
First group, ₱2.50	9.85	9.05	8.42	7.86

Simply stated, these figures mean: That when sound, fourth group logs, the forestry charge on which is ₱0.50 per cubic meter (424 board feet) are sawn into lumber in a mill that utilizes but 60 per cent of the merchantable contents of the logs, the forestry charge per one thousand board feet is ₱1.97; and if sawn in a mill that utilizes 75 per cent, the charge per thousand board feet is ₱1.57; which is equally true of all groups based on the respective price per cubic meter. A sawmill sawing first group timber, the legal forestry charge on which is ₱2.50 per cubic meter, in a mill utilizing 60 per cent of the raw material pays forestry charges at the rate of ₱9.85 per thousand board feet and if in a mill that utilizes 75 per cent, at the rate of ₱7.86 per M board feet. This method of measurement differs from that in vogue in the United States and Canada in that it compels the licensee to assume the burden of waste incident to lumber manufacture.

As a whole the above charges per thousand feet as compared with timbers of similar mechanical properties of the United States and other timber producing countries are comparatively low and it is felt that any reduction in price would have no other material results than to increase waste.

THE WORK IN BENGUET.

The Baguio Forest Nursery is maintained for the purpose of raising species which are adapted for reforestation purposes in the Mountain Province region. Reforestation is greatly needed in the Baguio City Reservation and the surrounding country; there is a large and constant demand for firewood and timber and in time the existing stands will be so thinned by constant use that they will be unable to meet the demand in the future. Of equal importance is the problem of reforesting the extensive grass areas in the mining district, where the supply of timber is diminishing and already many disputes have arisen regarding the rights of several parties to secure timber from claimed tracts. Provident companies have offered to coöperate with the Bureau of Forestry in planting up the denuded hills adjoining the mines, both to assure the future supply of mine timbers and to protect the stream sources, as some companies depend on water power to operate their mills. So far, the reforestation trials in Baguio consists of 2,777 plants, representing ten different species set out on grass land, and in broadcast sowing of Benguet pine on the same type of land.

The nursery is also used to raise ornamental shrubs and trees which are distributed free of charge to private persons and to supply the city of Baguio with the plants needed for the beautification of its parks and avenues. For this work of coöperation, the city pays the wages of five permanent laborers, which number is increased when the amount of work demands it. During 1916, 6,178 plants have been disposed of in this manner, having a sale value of about ₱4,642.15.

About a year ago, the delegate of the Secretary of the Interior made certain arrangements with this Bureau for the Baguio nursery to aid in the introduction of valuable economic trees such as cinchona, pili, and mango, for distribution to the Igorot inhabitants. Past work has shown that the native lowland species will not grow successfully in Baguio if not properly cared for, so great care is exercised in their propagation and handling. The above arrangement resulted in the assignation of ₱250 from the appropriation for Act No. 2444 to be expended in the building of glass frames in the Baguio nursery for the propagation of imported seeds. The plans for the coming year include trials of grafting and budding some of the unsuccessful exotic species on native stocks, as well as the continuation of tests of the available economic species.

The assistant forester assigned to this work of reforestation and nursery care is doing administrative work in supervising the work of the officer in charge of the Benguet district, especially in granting grazing and caiñgin permits.

With the increased use of firewood and timber in the Benguet region and the small stands of pine, it was found necessary to have a preliminary working plan for the intelligent management and administration of the remaining pine stands and the assistant forester will prepare such a plan the coming year.

This region is the centre of mining in the Philippine Islands and great inroads have been made on the stands of pine located on mining claims and on stands in the vicinity of claims. Whole areas have been denuded to such an extent that certain mining companies are not only short of timber but water as well, and furthermore, due to the geological formation existing in this region coupled with the removal of the soil cover, large slides have occurred. The larger mining companies have taken the matter up with the Bureau to coöperate in reforestation of such areas.

Another feature of the Bureau's work in connection with mining is the abuse of the mining law in staking out mining claims by so-called prospectors for the sole purpose of controlling the timber on the claims, and either selling outright the claims so staked to the larger legitimate mining companies in need of timber, or obtaining an ordinary timber license and selling the timber from their alleged claims to the operating mining companies as needed. The Bureau has changed its policy in that no more ordinary timber licenses are granted to holders of claims who are not bona fide operators, but the present mining law is so ambiguous, so lax in many of its requirements that it is impossible under present conditions for the Bureau to control the situation as fully as is necessary. The Bureau of Forestry should be given full control of the timber on all mining claims, allowing each bona fide miner sufficient timber for proper development, the judgment of what constitutes proper development to be decided by the Government entities concerned, after which the miner should be made to take out an ordinary timber license under the Bureau's regulations. Only in this way can future supply, denuding of the country, slides and constant friction between miners as well as licensees be adequately controlled.

COÖPERATION.

During the year the Bureau of Forestry coöperated with the United States Army Quartermaster Corps and with the United States Navy in the inspection and identification of cargoes of Philippine lumber at various times, as well as coöperation in reforestation with the United States Army at Camp John Hay, Baguio, on the areas surrounding the hydroelectric plant at that place. Forest reconnaissances were made for the military authorities, principally on small areas, from the standpoint of military usefulness, of the stand of timber and minor forest products.

The various local and foreign firms dealing in lumber and minor forest products have constantly made use of this Bureau for information concerning supply and the Bureau has acted as intermediary between these firms and the various licensees for the mutual benefit of both, as well as of the Government.

The distribution of seeds for beautification work as well as plantations was carried on throughout the Islands and active coöperation with the Bureau of Public Works in its roadside planting plan was continued. Botanical collections for special purposes in making the study of economic forest species of the Islands, such as the citrus fruits, were made in coöperation with the Bureau of Agriculture in Manila and with the Department of Agriculture at Washington, D. C. Wood identification for local contractors as well as in cases of dispute in the sale of timber was continued. Work was carried on in coöperation with the Department of Mindanao and Sulu in preparing working plans for the watershed of Zamboanga, teak plantations in Jolo, and in the reconnaissance of the Lake Lanao plateau. The Bureau of Forestry coöperated with the Bureau of Science in making study of the rope industry, using bast fibers of forest trees, in the northern part of Luzon, in collecting samples of herbarium materials, etc., as well as in the collection of materials for a complete study of medicinal plants occurring in the forests and in the testing of construction timbers. Coöperation has been carried on with several mining companies and in reforesting denuded areas for assured water supply, firewood, and future mining props. The Bureau has extensively coöperated with various manufacturing companies in trying to relieve the fuel situation brought on by the high price of coal in furnishing firewood as a substitute.

Active part was taken by the majority of the field personnel of the Bureau in coöperation with the Bureau of Education in making arbor day a success, as well as school garden days and clean-up week.

Forest officers coöperated in the locust campaign by reporting swarms of locusts to the local officials.

THE FUEL SITUATION.

During the last half of the year the price of coal has gone up to the extent that in December Japanese coal was selling at from ₱25 to ₱28 per ton and the situation became very acute; to relieve this condition the Bureau lent all its energies to increasing the output of firewood, and licenses were issued for every available area under strict regulations that the licensee would have to use his area to the fullest extent or his license would be canceled and given to one of the many other applicants.

The increase in the number of licenses, coupled with the enforced use of the license, immediately began to be felt in the larger centers by the population and to-day the United States Army is using firewood in place of coal to a considerable extent.

The Manila Railroad is using firewood in their locomotives on the south lines and the Philippine Railway on the Island of Panay is using upland firewood exclusively, the general manager stating that 2 to 2½ cords of wood equal a ton of Japanese coal, which amounts to a saving of ₱8 to ₱10 or more on every ton of coal for which wood has been substituted. Many manufacturing plants are also using firewood.

In 1915, 213,241 cubic meters of firewood were cut on which forest charges were paid, while this year charges were paid on 292,336 cubic meters, an increase of 79,095 cubic meters; this increase took place in the last three months of the year. The firewood cut from registered private woodlands, of which the Bureau has no accurate record, has been quadrupled, judging by the requests for registration and the reports submitted by rangers on the activity on private woodlands. Excluding the unknown quantity of firewood from private lands and assuming that only half of the above overproduction of 79,095 cubic meters was used in place of coal; assuming also that 2½ cords equal a ton of coal, which gives 8.87 cubic meters of stacked wood equal to a ton of coal; and assuming finally that every ton of coal displaced by cordwood means a saving of ₱10, then we get a saving of 4,458.5 tons of coal, or ₱44,585. While it is clear that these figures cannot be considered as more than a mere indication of the facts, still they show very clearly that the encouraging of the firewood business by the Bureau of Forestry during the last year has resulted in a very large saving to the people of the Philippines.

PANAMA-PACIFIC, FORMOSA, AND SAN DIEGO EXPOSITIONS.

The exhibit of the Bureau of Forestry at the Panama-Pacific Exposition in San Francisco was productive of big results in acquainting the people of the United States and foreign countries with the forest products of the Islands which has increased the export trade in forest products this past year and created a demand for certain minor forest products beyond what could be supplied.

The Exposition closed December 20, 1915, and the exhibit was ready for shipment by January 31, 1916. A large part of the exhibit was shipped to Formosa for the exposition at Taihoku, while a small portion was exhibited at the San Diego Exposition, at both places receiving the highest praise.

CLERICAL WORK.

As stated under the heading of "Personnel," the services of the two American clerks, one of whom was performing the duties of stenographer and the other as accountant, were dispensed with and their work has been taken up by Filipino clerks already employed in the Bureau. It is gratifying to report that the result accomplished by Filipino employees was very satisfactory and showed no detriment to the service. It is only just to state that, with the increase each year of the field force of the Bureau, no increase in the clerical force has been allowed and the present clerical force is inadequate to conduct the work promptly and efficiently, necessitating constant overtime work without any prospects of remuneration by an increase in salary for increased responsibility and additional work. This condition is not conducive to holding a clerical force which has been trained in the specialized work necessary in the Bureau of Forestry and is beginning to have its effect. One Filipino clerk resigned during the year, as he was offered a position which pays more in the forestry department of British North

Borneo. Another accepted a position with the Chinese Forest Service at Peking, China, at a substantial increase in salary.

PERSONNEL.

The most important change which took place in the personnel of this Bureau was the resignation of the Director, Mr. William F. Sherfesee, whose retirement from the service was granted late in the year, and the resignation and retirement of the chief of the divison of administration in April. Several rangers, most of whom are graduates of the Forest School, resigned. One accepted a better paid position in the forest department of British North Borneo. Two accepted cadetships in the Philippine Constabulary and are now serving in that Bureau as third lieutenants, while the rest either accepted better paid positions offered them or they continued their education. One American forester, who was in charge of the largest forest district, resigned during the year, having been offered a better paid position in British North Borneo. The services of the two American clerks, one of whom was performing the duties of a stenographer and the other as accountant, were dispensed with. One Filipino stenographer was offered a position in British North Borneo and resigned; one draftsman and one messenger also resigned. The following appointments were made during the year; 21 rangers, 19 of whom were graduated at the forest School, 1 formerly employed as temporary ranger and now made permanent, and 1 reinstated; 1 American forester to replace the forester that resigned during the year; 6 clerks, 2 draftsmen and 5 messengers. The permanent force on January 1, 1917, consisted of: One forester as Acting Director, 6 foresters, 1 wood technologist, 1 wood expert, 1 chief of forest maps, 1 instructor in forestry, 2 assistant foresters, 2 field assistants, 107 rangers, 5 draftsmen, 29 clerks, and 4 messengers, besides the following employed on a temporary status: 2 nurserymen (1 of whom devotes only one-third of his time to this Bureau), 1 draftsman, 7 laborers, 1 carpenter, 1 varnisher, 24 guards, 2 watchmen, 1 chauffeur, 1 launch engineer, 1 launch patron, 1 launch sailor, and one telephone operator, making a total of 201 employees.

INSUFFICIENCY OF FUNDS AND PERSONNEL.

The past year has not only shown progress in all the activities of the Bureau, but new work had to be inaugurated because of certain conditions prevailing. The increase for certain items in the appropriations of the Bureau of Forestry for 1916 was so small, that the force and funds of the Bureau were by no means sufficient to carry on all work as it should have been done. The Bureau spent during the past year ₱285,708.09 for the administration of 16 million hectares of forests with a maximum force of 201 employees of all grades.

To show, in comparison with other countries which in area are comparable with the Philippines, what an important position forestry occupies, in the opinion of Government officials and economists, no better example can be cited than that of Spain.

Forestry in Spain has passed through endless vicissitudes. While it is true that, as early as the thirteenth century, laws and regulations were passed for the protection of existing forests and the reforestation of waste lands, yet the practical results were almost nil; the efforts of the sovereigns in the matter bore no fruit, because there was never any responsible and competent body to carry out the provisions of the laws.

The first step toward any effective administration was taken in 1833, when a forest service was organized as a branch of the body of civil engineers, while at the same time a special school for foresters was to be established; this plan was finally put into effect in 1846.

At present the forest school has the following staff: One Director, who is also Director of the Bureau of Forestry (Inspección General de Montes), 15 foresters, belonging to the service as professors, and 4 assistant foresters as assistant professors. The organization is modeled on that of the German forest schools and the institution is the pride of the Spanish Forest Service.

The Bureau of Forestry as a separate government organization was created in 1853; it was at first under the Ministry of Public Works, later under that of Agriculture, and since 1910 under the "Ministerio de Fomento." For appointment as forester in the service, the applicant must have graduated from the school, served four years as assistant forester and, finally have carried out some special project by way of probation.

For years the forest service has had to carry on a constant struggle with other and higher powers in the Government in defense of the public forests, for the heavy public debt and other urgent financial needs have always threatened the alienation of the greater part of them. The Forest Law of 1863 specially charged the Bureau of Forestry with the regulation and administration of the public forests, but when one remembers that provincial governors, other officials appointed by these, and barrio officials had something to say about the nomination of the rangers, it is easy to see that political influences often made forest regulations null and void.

The frequent floods and droughts of recent years and the continual deficit in the forest service, which all the activities of of the body were unable to combat, finally forced the Government to give the service the attention it had long deserved. After the loss of the colonies in 1900, among many other political changes there was effected also a radical change in the forest service. The technical administration was completely separated from all political influences, being put entirely under the direction of the Ministry of Agriculture, to concentrate all its attention and efforts on the important problems of forestry. At the same time, the appropriations both for personnel and for general expenses were considerably augmented. In 1910 there were organized 10 hydrologic divisions for the study of projects of reforestation and protection of fishing streams; these are entirely distinct from the 22 administrative forest districts.

At present the forest service consists of 200 foresters, 138 assistant foresters, and 1,750 rangers and guards. They have under their charge some 5 million hectares of forests, which are divided into 22 administrative districts. Practically coextensive with the districts are the above-mentioned hydrologic divisions. The most important parts of their work fall under demarcation of boundaries, completing the catalogue of the classified public forests, acquisition by exchange or expropriation of land valuable for forest purposes, the unification of various ancient rights, redemption of ancient free use rights, working plans, regulation of private forests situated within protective zones, reforestation of watersheds and deforested mountains in general, and the encouragement and development of arbor day.

The appropriation for the forest service in 1915 was ₱1,500,000, of which sum only 43 per cent was covered by forest revenues; the deficit of 57 per cent was incurred almost entirely in carrying out reforestation projects. The difference between these figures and those of the Philippines is striking.

The revenue of the Philippine Bureau of Forestry during the past year amounted to ₱494,447.65 and the expenses incurred by the Bureau including the maintenance of the Forest School amounted to ₱285,708.09, leaving a surplus of ₱208,739.36, or a profit of 73 per cent on the cost, and this in spite of the fact that it is estimated that 30 per cent of the revenue which the Government should collect is lost, partly through false classification of timber within the four groups and partly through incomplete supervision of the measurement of timber on account of lack of personnel.

In Spain a great part of all public forests belong to the crown, to various communities, provincial governments, towns, and other official entities, beside a great number of extensive private forests. In the Philippines, on the other hand, 99 per cent of all forests belong to the Government, and only an insignificant part is private property. This difference of status brings with it the great advantage that the Government can derive much greater profits from the forest wealth and can much better regulate the proper ultimate disposition of the land.

Spain employs a large and expert technical personnel in reforesting those areas which the ignorance and improvidence of former times allowed to be devastated and to this purpose she annually devotes great sums of money, but the greater part of her public forests are accurately bounded and classified. In the Philippines, reforestation, except in a very few regions, is not a matter of such immediate necessity, but on the other hand, there is urgent need of a proper classification of the forests, in order to determine what part of our immense forest areas should be preserved either for permanent exploitation under systematic management or for protection of watersheds, and what parts should be thrown open to agriculture.

The most urgent and immediate need in the Philippines is the training of personnel of technical men, as well as subordinate officers, sufficiently numerous to carry out, gradually but constantly, the necessary work of delimiting and classifying the forests and to attend to all the needs that arise in connection with the growth of the lumber industry and other activities dependent on forest products. The present force of the Bureau of Forestry is barely able to attend to the mere routine of administrative work.

To state this somewhat more in detail: The first need, in order to make all more important lumbering regions more easily accessible and to save at once time and traveling expenses, is to increase the number of forest stations. The cost of establishing a new station, including all furniture and office supplies, plus rent for the first year, averages perhaps ₱550. This, taking into consideration the time and money spent in traveling from the present few and scattered stations to various outlying lumbering regions, is a very modest investment which would, however, soon bring in excellent returns by way of saving traveling expenses on one hand and bringing increased revenues, due to closer supervision, on the other.

Every such station needs, to attend to the work of supervision, from one to three rangers. In spite of deaths and resignations, the number of rangers graduating annually from the Forest School is sufficient to maintain the necessary increase of personnel, provided the appropriations are granted to employ them.

Arthur F. Fischer

Director of Forestry.

The SECRETARY OF
AGRICULTURE AND NATURAL RESOURCES,
Manila.

APPENDIXES.

APPENDIX A.—FOREST RECONNAISSANCES.

SAMAR ISLAND.

In accordance with the policy of the Bureau of Forestry of detailing, during the most convenient season of the year, all the available personnel to the reconnaissance of forest regions which are almost or entirely unknown, several parties were organized and, under the supervision of the chief of the section of forest maps, made a series of reconnaissances in the Island of Samar from April to July, for the purpose of locating those forest areas which because of their importance deserve a more careful study for lumbering enterprises, those that should be preserved for the protection of streams, and tracts of land that should and can be opened up for agriculture.

A short abstract of this reconnaissance is here given, comprising the points which are of special interest to foresters and lumbermen.

The Island of Samar, the largest and easternmost of the Visayan group and the third in area among the Philippines, lies between latitude 11° 01′ and 12° 36′ north and longitude 124° 16′ and 125° 46′ east of Greenwich. Its entire area of 12,030.29 square kilometers (5,031 square miles) is very irregular and rugged in character and is cut up into deep gullies and intersected by low mountain ranges. The highest peaks do not exceed 3,000 feet.

The coast of Samar, also, is very irregular and rugged in character, being surrounded by innumerable small islands and reefs, some of which furnish good anchorage for vessels. Navigation on the northern and eastern coast is difficult and dangerous due to the fact that this coast is exposed to the northeastern monsoon.

Many rivers may be used for transportation and the Catubig is navigable for a boat drawing 12 feet of water up to Las Navas. The innumerable falls and cascades which occur in many rivers may be utilized for water power.

VEGETATION.

For the present purpose, the vegetation of the region is divided into four classes: Commercial forest, noncommercial forest, cultivated lands, and open or grass lands.

"Commercial forest" is that which contains sufficient timber to justify the establishment of a lumbering enterprise, and "noncommercial," that which could not sustain such an industry, but can supply enough timber for local uses or for small logging operations.

The following table shows the relative areas of each class and their relation to the whole area of the Island:

Type of vegetation.	Hectares.[a]	Acres.	Area.
			Per cent.
Commercial forest	983,029	2,429,065	81.71
Noncommercial forest	58,000	143,318	4.82
Cultivated lands	130,000	321,230	10.81
Open or grass lands	32,000	79,142	2.66
Total	1,203,029	2,972,755	100.00

[a] 1 hectare = 2.471 acres.

On the whole Island, 520 hectares of forest valuation surveys were carried on in 23 different forest areas and two tidal swamp areas. In order to facilitate the work, the Island was divided into 22 compartments, and the most important data regarding forest exploitation are described below, together with tables showing the result of forest valuation surveys of each compartment.

COMPARTMENT NO. 1.

The forest region south of the Lavezares-Bobon road is generally rugged in character and is traversed from south to north by several streams of little importance and by the Hingarog and Bobon Rivers, which in part may be used for the transportation of logs. In the region north of this road as well as in most of the Islands forming the Balicuatro group there are some mangrove swamp areas.

In this compartment steam logging can be carried on under an exclusive long term license to supply a sawmill with a daily output of about 25 to 30 cubic meters. A good sawmill site is available at Carañgian. The exploitation of mangrove firewood and tanbark could be carried on by a company lumbering in this compartment.

Though the logging is difficult, this is to a great extent compensated for by the quantity and quality of the stand of timber.

The stand per hectare is 124.57 cubic meters or 31,142.5 board feet, distributed among the following species in the order of their abundance: Mayapis, lauan, apitong, toog, balobo, palosapis, tanguile, mangasinoro, antipolo, macaasim, and other miscellaneous species. These estimates apply to 10,000 hectares.

COMPARTMENT NO. 2.

Valleys and basin of the Catarman River.—The valleys formed by the Paticoa, Hibabalayan, and Hinotian Rivers, which are tributaries to the Catarman, are undulating plains, with low bordering hills suitable for the cultivation of coconuts and abaca.

Logging should be restricted to small ordinary licenses, in order to retain sufficient forest cover on the hills.

By taking advantage of the river courses, transportation should offer no difficulty, but the relative quantity and quality of the stand of timber and the difficulty of shipping it out make the establishment of a sawmill in this compartment inadvisable. The stand per hectare is 79.85 cubic meters or 19,962.5 board feet, distributed among the following species in the order of their abundance: Lauan, apitong, toog, mayapis, amugis, guijo, yacal, tanguile, macaasim, catmon, and other miscellaneous species. These estimates apply to 12,000 hectares.

COMPARTMENT NO. 3.

Mondragon and Bugko Valleys.—This region is more heavily timbered than the Catarman valley and is recommended for ordinary licenses, but for local consumption only. The extraction of timber is somewhat difficult and the coast is dangerous because of the absence of a port or anchorage ground, and therefore logging for export is not recommended.

The stand per hectare is 90.29 cubic meters or 22,582.5 board feet, distributed among the following species in the order of their abundance: Lauan (bagtican, white lauan, almon), apitong, toog, mayapis, balobo, macaasim, tambalao, yacal, guijo, malaikmo, catmon, and other miscellaneous species. These estimates apply to 10,000 hectares.

COMPARTMENT NO. 4.

Valley of the Pambujan River.—This tract is traversed by the Pambujan River, which is the longest in Samar. It rises nearly 15 kilometers northeast of Calbayog and flows to Laoang Bay. Its length is more than 100 kilometers and it has numerous small tributaries.

This region is an undulating valley, with here and there level tracts along the river, inclosed by chains of hills and mountains. Although the soil of this region is not very fertile, it produces a considerable amount of abaca; from Suba north the land is somewhat more level and of better quality.

From a commercial point of view the forest in this region is of little value and therefore it is recommended that the same be opened to agriculture, restricting the use of the forest so as to protect the streams.

The stand per hectare is 68.45 cubic meters or 17,112.5 board feet, distributed among the following species in the order of their abundance: Lauan, toog, tanguile, apitong, antipolo, guijo, narra, amuguis, catmon, macaasim, dao, and other miscellaneous species. These estimates apply to 20,000 hectares.

COMPARTMENT NO. 5.

Catubig Valley and Laoang and Batag Islands.—The Catubig valley is made up of plains of alluvial origin and is agricultural in character, particularly along the Catubig River, where there are level tracts of more than 5 kilometers in width. Coconuts, abaca and rice are the crops for which this region is best adapted.

The Catubig River is navigable for larger boats to Las Navas, and therefore the shipment of agricultural products offers no difficulty.

Logging in this part of the Island is recommended only under ordinary licenses.

At the mouth of the Catubig River there is a small delta containing about 400 hectares of tidal swamp. The quantity and quality of the stand of timber in this swamp in the order of their abundance is as follows: Api-api, bacauan, busain, tabigi, tangal. The total average stand per hectare is 22.37 cu. m.

COMPARTMENTS NOS. 6 AND 7.

Palapag and Gumay Valleys.—A careful study of this region should be made before a lumbering enterprise is started in order to ascertain whether it should be logged as a single concession, including the valley of Oras, or divided into two lesser concessions.

These valleys are topographically almost identical, consisting of level tracts from 1 to 5 kilometers wide along the coast, a part of them being swamps and the rest highland with here and there broken chains of hills. Outside of the swamps, there are many tracts planted to abaca. Immediately behind these plains, there is a plateau reaching an elevation of from 200 to 300 feet above sea level in which a good stand of timber is found, with excellent reproduction. The land as a whole offers no difficulty in the extraction of logs and even though there are a few hills scattered throughout the tract, a railroad could be put in.

A careful study should be made regarding the railroad and water transportation, as there appear to be good prospects for logging this region.

The suggested sawmill sites are at Palapag, Nabatasan River at the south of Palahan Island, in Gumay and Oras, where there are good anchorages for vessels of more than 18 feet draft.

The Oras River is affected by tides, reaching as far as Hipapad Settlement and is navigable for launches drawing 5 feet. On the banks of this river, for 8 kilometers from the mouth, the land is level with few swamps, and is generally agricultural in character.

As a whole, the forest condition is somewhat better than that of Palapag, not only because there are areas supporting good stands of Narra, Tindalo, and other valuable commercial species, but also because of the apparent ease with which it may be logged.

The stand per hectare of timber in the Palapag valley is 107.30 cubic meters or 26,825 board feet, distributed among the following species in the order of their abundance: Lauan (bagtican, white lauan, almon), red lauan, tanguile, toog, apitong, mayapis, amugis, mangasinoro, dao, guijo, malugay, and other miscellaneous species. These estimates apply to 15,000 hectares.

The stand per hectare of timber in the Oras River Valley and tributaries is 71.32 cubic meters or 17,830 board feet, distributed among the following species in the order of their abundance: Lauan, yacal, red lauan, toog, guijo, apitong, tanguile, macaasim, mangasinoro, mangachapuy, narra, antipolo, bolongeta, and other miscellaneous species. These estimates apply to 25,000 hectares.

COMPARTMENT NO. 8.

The important forest in this region lies in the Dolores River Valley, west of Maslog Settlement, but the rugged condition of the area, the swiftness of the current in the river and the numerous falls make it impossible to use the river for the transportation of logs. At the head of the river there is an extensive basin with scattered broken chains of hills, the peaks of which reach an elevation of about 200 feet above the basin.

On account of the difficulties in transportation and also because of lack of supplies at the time when this territory was examined, forest valuations were made only as far as the sitio Carayacay, in the vicinity of Maslog, but by rapid ocular estimate it was judged that in the western part the timbered area is more valuable both in quantity and quality, with an average of 250 cubic meters per hectare. The most important species are lauan, tanguile, yacal or guisoc, with a few trees of molave, narra, and tindalo, and although toog is found in considerable amounts, this species is not so abundant as in other parts of the Island.

The size of the trees in this tract is fairly good, with an average of 15 meters in length by 75 centimeters in diameter, and the timber stand is sufficient for the establishment of a large lumbering enterprise. Reproduction is excellent.

The Dolores River being dangerous and difficult for the transportation of logs, and the distance from the center of this tract to the coast being more than 40 kilometers, the difficulties and great expense in the construction of railroad, and the absence of a port in the eastern coast, suggest that an investigation be made as to the means of transportation to the western coast, including the eastern part of compartment No. 20 or the Blanca River, a tributary of the Gandara, or to the western watersheds of Mount Hurao in the settlement of San José de Buan.

Logging to the eastward of the Maslog Settlement and in the valley of the Ulot River should be under ordinary licenses, and all level areas should be opened to settlement.

The stand per hectare is 91.01 cubic meters or 22,752.5 board feet, distributed among the following species in the order of their abundance: Lauan (bagtican, white lauan, almon), yacal, red lauan, toog, apitong, narra, guijo, pili (pagsahingin and pili), malaikmo, palosapis, dungon, amugis, tanguile, tamayuan, and other miscellaneous species. These estimates apply to 20,000 hectares.

COMPARTMENT NO. 9.

Mactaon or Malinao Valley and Sulat.—Because of the rugged condition of this tract, logging is difficult, but owing to the good stand of timber, not only in quantity but in quality, it is worth considering. Logs could be hauled either by donkey engines or by animals to those parts of the streams suitable for rafting. This tract is recommended for a small concession with a daily output of about 25 cubic meters.

Sulat Bay and the port of Libas, particularly the latter, offer good sites for sawmills.

The stand per hectare is 128.59 cubic meters or 32,147.5 board feet, distributed among the following species in the order of their abundance: Lauan (bagtican, white lauan, almon), tanguile, guijo, palomaria, yacal, almaciga, macaasim, dao, tiga, bolongeta, malugay, apitong, alupag, balobo, mangasinoro, narra, and other miscellaneous species. These estimates apply to 18,000 hectares.

COMPARTMENT NO. 10.

Beginning from the confluence of the Balangao River, the Borongan River may be used for transportation, but west of this transportation is impossible, due to stream obstructions. The rivers south of Borongan present the same difficulties.

The stand of timber is fairly good, but on account of the ruggedness of the tract, logging is difficult. This tract should be developed only under ordinary licenses.

The stand per hectare is 164.23 cubic meters or 41,057.5 board feet, distributed among the following species in the order of their abundance: Lauan (bagtican, white lauan, almon), apitong, mayapis, tanguile, mangasinoro, yacal, guijo, narra, and other micellaneous species. These estimates apply to 10,000 hectares.

COMPARTMENT NO. 11.

The Suribao Valley.—In general, the basin of the Suribao River is recommended for a concession with a daily output of about 40 cubic meters; although the tract is somewhat rugged, it has the advantage of being crossed by several tributaries of the Suribao, most of which are large enough for rafting. Another advantage is its suitability for steam logging. A mill site is available at Suribao, and a small railroad could be built to transport the lumber to the port of Lalawigan at Borongan.

The stand per hectare is 87.97 cubic meters or 21,992.5 board feet, distributed among the following species in the order of their abundance: Mayapis, apitong, yacal, lauan, tanguile, mangasinoro, tiga, narra, macaasim, and other miscellaneous species. These estimates apply to 25,000 hectares.

COMPARTMENT NO. 12.

Llorente and Tongkip Valleys.—There is a heavy stand of commercial timber, but it is inaccessible owing to the ruggedness of the tract. The parts which may be reached and for which the Llorente and Tongkip Rivers can be used for water transportation would supply a small sawmill and should be developed under ordinary licenses.

The stand per hectare is 172.80 cubic meters or 43,200 board feet, distributed among the following species in the order of their abundance: Apitong, narra, mayapis, lauan, guijo, sudyang, mangasinoro, yacal, palosapis, tanguile, palomaria, and other miscellaneous species. These estimates apply to 10,000 hectares.

COMPARTMENT NO. 13.

Not examined.

The stand per hectare is 159.35 cubic meters or 39,837.5 board feet, distributed among the following species in the order of their abundance: Sudyang, bansalagin, lauan, yacal, mayapis, macaasim and other miscellaneous species. These estimates apply to 8,000 hectares.

COMPARTMENT NO. 14.

Balangiga.—This compartment is recommended only for ordinary licenses, due to the limited stand of timber and the difficulties of transportation.

The stand per hectare is 78.39 cubic meters or 19,597.5 board feet, distributed among the following species in the order of their abundance: Lauan (bagtican, white lauan, almon), mangasinoro, tiga, yacal, guijo, agoho, sudyang, tanguile, bitanhol, macaasim, bansalagin, mangachapuy, apitong, and other miscellaneous species. These estimates apply to 10,000 hectares.

COMPARTMENT NO. 15.

The tract of land from Alabat Point to barrio Nouvilas may be logged to a slight extent, as this tract should be conserved as a protective forest. The valley of the Sohoton or Basey may be logged on a larger scale by clear cutting on those areas which are suitable for agriculture. Logging is rather difficult and the Sohoton or Basey River can be used for 10 kilometers; the forest is dotted with clearings due to caiñgin making.

The stand per hectare is 84.53 cubic meters of 21,132.5 board feet, distributed among the following species in the order of their abundance: Apitong, lauan, mangasinoro, mayapis, toog, macaasim, tiga, bitanhol, banuyo, narra, ipil, catmon, and other miscellaneous species. These estimates apply to 25,000 hectares.

COMPARTMENT NO. 16.

Santa Rita and Villareal.—A few scattered areas supporting a heavy stand of commercial species occur in this compartment, but owing to the difficulties of logging, this compartment is not suited for large operations.

The stand per hectare is 253.77 cubic meters or 63,442.5 board feet, distributed among the following species in the order of their abundance: Lauan, yacal, apitong, mangachapuy, narig, malanobo, nato, macaasim, amugis, malaikmo, baticulin, molave, tindalo, and other miscellaneous species. These estimates apply to 6,000 hectares.

COMPARTMENT NO. 17.

Daram and Buad Islands.—Buad Island is open in character and supports extensive cogon areas on lands which are not fitted for agriculture and which should be reforested.

Daram Island supports a few small forest areas with a heavy stand of trees, but there are also vast cogon areas unfitted for agricultural purposes, which should be reforested.

Logging in these islands should be restricted to licenses for local use.

The stand per hectare is 135.09 cubic meters or 33,772.5 board feet, distributed among the following species in the order of their abundance: Yacal, lauan, apitong, balobo, tanguile, guijo, palomaria, tindalo, molave, ata-ata, narra, balukanad, taluto, dao, macaasim, and other miscellaneous species. These estimates apply to 2,000 hectares.

COMPARTMENT NO. 18.

Calbiga-Wright.—The forests in this compartment have been almost destroyed by caiñgin makers; only small areas with a fairly good stand of trees occur, but as a whole, owing to difficulties in transportation, they are inaccessible to modern exploitation.

The Calbiga River is navigable for a boat of about 5 feet draft to San Mauricio, but hauling logs to this place is very difficult and can be done only by carabaos.

The stand per hectare is 170.64 cubic meters or 42,660 board feet, distributed among the following species in the order of their abundance: Lauan (bagtican, white lauan, almon), yacal, tanguile, molave, apitong, mayapis, gubas, guijo, amugis, macaasim, malaikmo, taluto, banuyo, bitanhol, oak, and other miscellaneous species. These estimates apply to 8,000 hectares.

COMPARTMENT NO. 19.

Catbalogan-Tarangnan.—This region is largely deforested, containing only scattered stands of timber difficult of access; most of the territory is covered with cogon and should be reforested.

Logging should be restricted to supplying local demands.

The stand per hectare is 92.72 cubic meters or 23,180 board feet, distributed among the following species in the order of their abundance: Lauan (bagtican, white lauan, almon), mangachapuy, apitong, tanguile, guijo, duguan, alupag, mangasinoro, dao, amugis, bitanhol, camagon, macaasim, bolongeta, and other miscellaneous species. These estimates apply to 5,000 hectares.

COMPARTMENT NO. 20.

Valley of the Gándara River and its tributaries.—Being traversed by the Gándara or Matuguinao River, this territory may be divided into two parts. The eastern part or the basin of the Blanca River, a tributary of the Gándara, including the Mapapacao, Colongcogon, and Hurao Mountains, is worth studying for the establishment of a large lumbering enterprise; even though the tract is somewhat rugged, transportation facilities may be established without much difficulty by rail or by aerial cable to the Gándara and Blanca Rivers.

A good sawmill site is at the confluence of the Gándara and Bulao Rivers. From Gándara, sawn timber may be transported on large scows to Napalisan Island, at the mouth of the Gándara River, where a yard could be located. Vessels of more than 15 feet draft can anchor, although exposed to the southwest monsoon; such vessels could find shelter in Libucan Island, about 6 kilometers south.

There are small bays along the coast between Catbalogan and Calbayog, but on account of the water being only 6 to 12 feet deep, they are of no use.

Logging to the south and west of the Bulao River must be restricted, as forest preservation is necessary for the protection of stream flow. Lumbering in the western part of this compartment is recommended under ordinary licenses only.

The stand per hectare is 129.71 cubic meters or 32,427.5 board feet, distributed among the following species in the order of their abundance: Lauan (bagtican, white lauan, almon), tanguile, mayapis, apitong, macaasim, guijo, yacal, amugis, dao, narra, bolongeta, and other miscellaneous species. These estimates apply to 30,000 hectares.

COMPARTMENT NO. 21.

Calbayog-Oquendo.—Logging operations in the eastern part of the Oquendo Valley and in the jurisdiction of Calbayog must be rigidly restricted in order to protect the abaca plantations, and the suitable areas should be planted to this crop.

In the western part of the Oquendo Valley and in the valley of the Saymonini River to the coast, forest exploitation can only be carried on under ordinary licenses, because of difficulties in transportation due to the ruggedness of the tract.

The stand per hectare is 134.66 cubic meters or 33,665 board feet, distributed among the following species in the order of their abundance: Lauan, apitong, mayapis, mangasinoro, toog, tanguile, malaikmo, amugis, tiga, antipolo, and other miscellaneous species. These estimates apply to 15,000 hectares.

COMPARTMENT NO. 22.

Mauo and Bunglasan Valleys.—This region may be operated under a long term exclusive license for a daily output of about 40 cubic meters.

Although a considerable number of rapids and falls occur in the Mauo and Bunglasan Rivers, they may be used for transportation to a distance of several kilometers.

Two places were selected for the mill site, namely, on the Mauo Gulf or at Barrio Erenas.

The stand per hectare is 136.83 cubic meters or 34,207.5 board feet, distributed among the following species in the order of their abundance: Lauan (bagtican, white lauan, almon), apitong, tanguile, narra, toog, macaasim, guijo, dalingdingan, pili (pagsahingin and pili), and other miscellaneous species. These estimates apply to 20,000 hectares.

COMPARTMENT NO. 23.

Capul and Dalupiri Islands.—They are considered of no forest value. The stand per hectare is 139.49 cubic meters or 34,872.5 board feet, distributed among the following species in the order of their abundance: Narra, malapaho, apitong, lauan, tamayuan and other miscellaneous species. These estimates apply to 500 hectares.

SUMMARY.

The most convenient sites for mills of larger capacity are: Carañgian, Palapag, Gumay, Oras, Sulat, Libas, Suribao, Loquilocon, Gándara, and Mauo.

Beside these, in case of a large lumbering enterprise, a combination of several compartments may be made at Palapag, Gumay, and Oras, upper valley of the Dolores and Oras, or the former with the Blanca valley, a tributary of the Gándara River.

In general, the Island of Samar is heavily timbered, but the country being subject to typhoons, the trees are somewhat damaged, particularly on the northern and eastern coast, where the trees are also smaller.

Because of the difficulties in logging due to the mountainous character of the island, the use of portable sawmills is recommended. In case there is a big demand for timber, the regions of Suribao and Llorente, Loquilocon, upper Ulot and Concord, Dolores and Gándara, which contain enough timber to support a large lumbering operation, should be studied to solve the problems of logging.

The central part of the island, between Calbiga and Borongan, as well as the regions which are not readily accessible for timber exploitation, contain extensive areas of Almaciga trees which, under the proper methods, may be exploited for resin. This product, if taken out together with rattan, would bring good returns.

The valleys of Bobon, Catarman, Bugko, Pambujan, Catubig, Oras to Hipapad, Dolores to Maslog, Ulot to Tula, Tubig or Malinao to Concord, Basey or Sohoton, Silaga to San Eduardo, Calbiga to Abaca and Buluan, Oquendo to Tarabucan, and Saymonini to Dao and Macatingog should be opened up more to agriculture with no other forest limitations than those necessary for the protection of streams and the prevention of erosion.

During this reconnaissance an investigation was also made regarding the general conditions of the mangrove swamp forests; the tables and estimates for these have not been finished.

Small reconnaissances have also been made on the Islands of Polillo and Alabat.

APPENDIX B.—STATISTICAL TABLES.

TABLE NO. 1.—*Statement of the certifications made to the Bureau of Lands regarding the agricultural or forest value of public land applied for as homesteads or for purchase or lease.*

Fiscal year.	Homesteads.			Sale applications.		
	Agriculture.	Forest.	Total.	Agriculture.	Forest.	Total.
1905	80	6	86	8		8
1906	318	16	334	20	1	21
1907	881	19	900	23		23
1908	2,456	51	2,507	49	1	50
1909	1,523	187	1,710	26	3	29
1910	1,175	385	1,560	34	5	39
1911	1,528	221	1,749	46	3	49
1912	2,609	301	2,910	95	11	106
1913	2,680	269	2,949	104	30	134
1913 (July 1 to Dec. 31)	1,653	159	1,812	81	16	97
1914	4,812	685	5,497	279	36	315
1915	5,965	688	6,653	317	52	369
1916	6,015	670	6,685	227	18	245
Total	31,695	3,657	35,352	1,309	176	1,485

Fiscal year.	Leases.			Grand total.
	Agriculture.	Forest.	Total.	
1905	0			94
1906	1		1	356
1907	12		12	935
1908	26		26	2,583
1909	27		27	1,766
1910	42	2	44	1,643
1911	30	1	31	1,829
1912	47	1	48	3,064
1913	47	1	48	3,131
1913 (July 1 to Dec. 31)	41	3	44	1,953
1914	77	1	78	5,890
1915	70	1	71	7,093
1916	55	4	59	6,989
Total	475	14	489	37,326

NOTE.—Total number of homestead, sale, and lease applications pending inspection December 31, 1914, 2,961; December 31, 1915, 2,243; December 31, 1916, 3,493.

This increase in pending homesteads is due to the increase in the number of requests received from the Bureau of Lands.

TABLE No. 2.—*Statement showing amounts in cubic meters of important timbers, by species, cut and invoiced in the Philippine Islands during the fiscal years 1910 to 1916.*

Species.	Fiscal year— 1910	1911	1912	1913	July 1 to Dec. 13, 1913.
Lauan	43,439	46,942	57,036	81,469	20,249
Apitong	20,764	21,096	28,929	32,391	12,905
Tanguile	2,106	2,762	3,999	5,249	3,390
Guijo	14,107	14,231	18,579	17,279	7,841
Yacal	8,225	8,150	14,491	21,770	5,593
Ipil	13,717	12,296	17,237	15,791	7,535
Molave	8,923	7,978	9,091	9,363	4,783
Narra	5,744	4,996	8,474	8,877	3,941
Calantas	3,174	1,368	938	3,320	886
Palosapis	----------	----------	----------	----------	----------
Mangachapuy	----------	----------	----------	----------	----------
Macaasim	705	1,094	1,239	699	267
Dungon	2,453	1,693	1,213	931	601
Tindalo	954	1,018	794	932	484
Acle	809	867	1,295	1,690	729
Amugis	1,039	735	1,108	645	252
Supa	1,062	944	542	297	141
Betis	----------	----------	----------	----------	----------
Malugay	----------	----------	----------	----------	----------
Other species:					
First group	574	822	707	1,000	687
Second group	4,900	4,606	6,207	7,547	2,858
Third group	7,277	10,192	10,688	8,066	2,747
Fourth group	36,786	41,655	42,981	59,855	25,613
Total	176,758	182,945	224,948	277,171	101,503

Species.	Fiscal year— 1914	1915	1916	Total 1910 to 1916.
Lauan	74,453	73,277	107,634	504,499
Apitong	32,828	38,849	52,529	249,326
Tanguile	14,682	15,460	28,961	76,609
Guijo	19,701	15,650	16,685	124,073
Yacal	15,115	14,714	16,471	104,529
Ipil	17,602	12,089	14,147	110,414
Molave	9,753	10,546	10,788	71,225
Narra	8,467	9,868	7,970	58,337
Calantas	2,423	1,999	4,574	18,682
Palosapis	2,222	1,631	2,723	6,576
Mangachapuy	1,469	1,859	2,666	5,994
Macaasim	1,293	806	1,322	7,425
Dungon	2,199	1,467	1,127	11,684
Tindalo	914	1,181	1,115	7,392
Acle	1,287	1,498	1,088	9,263
Amugis	770	612	520	5,681
Supa	596	383	162	4,127
Betis	----------	----------	158	158
Malugay	----------	----------	44	44
Other species:				
First group	2,196	2,190	2,916	10,522
Second group	7,484	5,751	6,454	45,807
Third group	6,787	6,308	4,694	56,749
Fourth group	73,017	60,130	56,694	396,731
Total	294,633	276,268	341,442	1,935,847

TABLE No. 3.—*Revenue derived from the sale of forest products, and expenditures of the Bureau of Forestry since its organization, April 14, 1900.*

Fiscal year—	Revenue.	Expenses.	Surplus.	Expenses.
				Per cent.
1901 to 1906	₱2,268,591	₱1,118,887	₱1,149,704	49
1907	191,080	105,050	86,030	55
1908	211,571	107,242	104,329	51
1909	251,880	115,049	136,831	45
1910	271,582	152,161	119,421	56
1911	334,763	160,476	174,287	48
1912	354,685	200,840	153,845	57
1913	390,664	227,048	163,616	59
1913 (July 1 to Dec. 31)	160,913	141,131	19,782	88
1914	442,661	256,990	185,671	58
1915	425,817	274,176	151,641	64
1916	494,447	285,708	208,739	58
Total	5,798,154	3,144,758	2,653,396	[a]57.33

[a] Average.

TABLE No. 4.—*Revenue from sale of forest products, January 1 to December 31, 1916.*

Provinces.	Amount.	Provinces.	Amount.
Agusan	₱2,731.10	Misamis	₱6,049.30
Albay	7,582.01	Mountain	5,005.56
Ambos Camarines	13,807.46	Negros Occidental	13,955.07
Antique	409.20	Negros Oriental	2,897.34
Bataan	10,327.58	Nueva Ecija	4,523.13
Batangas	4,058.74	Nueva Vizcaya	128.65
Bohol	2,137.91	Palawan	2,508.33
Bulacan	4,833.33	Pampanga	693.30
Cagayan	15,713.53	Pangasinan	6,047.36
Capiz	2,622.30	Rizal	2,792.89
Cavite	328.70	Samar	4,676.33
Cebu	2,609.97	Sorsogon	30,433.51
Cotabato	3,133.92	Sulu	1,164.42
Davao	4,073.55	Surigao	1,333.65
Ilocos Norte	1,191.03	Tarlac	1,078.58
Ilocos Sur	3,385.01	Tayabas	20,787.65
Iloilo	13,038.43	Zambales	2,668.79
Isabela	6,397.94	Zamboanga	48,219.93
Laguna	2,306.77		
La Union	290.69	Total charges	451,602.33
Lanao	1,588.58	Total fines and penalties	42,845.32
Leyte	10,457.90		
Manila	211,603.63	Grand total	494,447.65
Mindoro	4,853.48		

The above list shows the places where the forest charges were collected and not always where the products were gathered. This accounts for the large receipts shown by the principal market centers.

TABLE No. 5.—*Timber licenses in force during the fiscal year 1916 (January 1 to December 31, 1916).*

Provinces.	Commercial licenses.					Gratuitous licenses.				
	For less than 100 cubic meters.	For 100 cubic meters and less than 1,000 cubic meters.	For 1,000 cubic meters and over.	License agreements.	Total commercial licenses.	For personal use. In communal forests.	For personal use. Outside communal forests.	For public work; second and lower group.	Miner's gratuitous licenses.	Total.
Albay	3	22	6	------	31	12	7	------	------	19
Ambos Camarines	30	57	7	1	95	13	10	2	20	45
Antique	7	1	------	------	8	------	------	------	------	------
Bataan	6	22	14	1	43	1	------	------	------	1
Batangas	7	3	1	------	11	------	2	------	------	2
Bohol	8	3	------	------	11	15	60	7	------	82
Bulacan	1	8	------	------	9	------	4	2	8	14
Cagayan	15	71	3	------	89	58	97	5	------	160
Capiz	43	11	1	------	55	14	22	11	------	47
Cebu	16	9	------	------	25	21	29	1	------	51
Ilocos Norte	48	12	------	------	60	26	------	1	------	27
Ilocos Sur	47	29	------	------	76	19	44	4	------	67
Iloilo	22	11	------	------	33	1	------	1	------	2
Isabela	8	46	------	------	54	49	------	2	------	51
Laguna	25	23	2	------	50	------	26	------	------	26
La Union	3	4	------	------	7	9	------	------	------	9
Leyte	45	52	3	------	100	8	319	8	------	335
Mindoro	5	49	5	------	59	------	35	4	------	39
Misamis	14	6	2	1	23	25	74	1	------	100
Mindanao and Sulu	70	30	22	2	124	24	199	11	------	234
Mountain Province	68	7	4	2	81	2	14	5	4	25
Nueva Ecija	20	23	------	------	43	24	33	------	------	57
Nueva Vizcaya	5	------	------	------	5	1	12	1	------	14
Negros Occidental	26	43	1	2	72	5	22	1	------	28
Negros Oriental	8	13	------	------	21	2	26	1	------	29
Palawan	8	12	23	------	43	------	47	4	------	51
Pampanga	3	4	------	------	7	------	------	------	------	------
Pangasinan	41	41	------	------	82	47	35	8	------	90
Rizal	11	8	------	------	19	1	2	------	------	3
Samar	60	24	2	------	86	71	32	------	------	103
Sorsogon	3	3	------	------	6	15	61	6	4	86
Surigao	21	3	2	------	26	28	85	3	2	118
Tarlac	7	3	------	------	10	------	65	2	------	67
Tayabas	19	81	8	1	109	17	9	2	------	28
Zambales	18	7	3	------	28	25	------	2	7	34
All provinces	------	------	------	------	------	------	------	1	------	1
Total	741	741	109	10	1,601	588	1,371	96	45	2,045

NOTE.—There was no license issued in the provinces of Batanes and Cavite.

In Cagayan and Isabela 2,123 licenses were issued for building tobacco curing houses. The timber authorized to be cut under these licenses amounts to 15,600 cubic meters of first and 34,500 cubic meters of lower group timber.

TABLE No. 6.—*Report of the utilization of forest products from public forests of the Philippine Islands during the fiscal year 1916 (January 1 to December 31, 1916).*

Provinces.	Timber.					Firewood.		Charcoal.	Dyewood.	Tan bark.	Dyebark.	Wood-oils.
	Group.				Total.	Class.						
	First.	Second.	Third.	Fourth.		First.	Second.					
	C. meters.	*C. meters.*	*C. meters.*	*C. meters.*	*C. meters.*	*C. meters.*	*C. meters.*	*C. meters.*	*Kilos.*	*Kilos.*	*Kilos.*	*Liters.*
Albay	719	680	778	1,882	4,009	4,245	1,515	11		9,979	300	216
Ambos Camarines	2,307	2,404	6,335	1,705	12,751	13,204	12,404			11,980	4,400	
Antique	4	9	2	156	171		55					
Bataan	7	3,204	33,288	10,485	46,984	2,484	4,134	361		801		
Batangas	130	24	3	82	239	3	1,514	3		97,426		
Bohol	221	12	20	500	753	3,587	2,945	6		8,048		100
Bulacan	58	176	148	5,338	5,720	222	119	410		8,084		
Cagayan	4,636	899	1,275	2,417	9,227	19	3,908			11,450		100
Capiz	38	50	771	3,268	4,127	3,975	5,467	60				6,017
Cavite							2,362	76		14,667		
Cebu	71	30	28	221	350	109	581	5	867	13,198		
Ilocos Norte	220	135	97	209	661	213	187					
Ilocos Sur	637	629	276	309	1,851	162	1,364			187	207	
Iloilo	81	30	65	551	727	3,839	26,385	33	2,377,309	197,685		
Isabela	1,354	668	464	370	2,856		111					
Laguna	3	113	113	971	1,200		2,415	67		27,176	1,650	
La Union	66	20	3	36	125		13					
Leyte	901	577	1,485	3,334	6,247	1,679	1,017	7		900		35,964
Mindanao and Sulu:												
Agusan	846	54	14	66	980	95				8		
Bukidnon												
Cotabato	3,171	3,097	1,379	1,693	9,340	298	16,653					
Davao	28	21		26	75	278	504			300		
Lanao	282	1,536	9,777	27,366	38,961		700					
Sulu	1,015	592	7	13	1,627	1,008				113,435		
Zamboanga	11,662	4,683	7,949	20,961	45,245	2,488	571	27		414,690		
Mindoro	1,568	3,354	123	7,942	12,987	3,048	563	25		138,851	33,546	
Misamis	607	299	263	1,160	2,329	47	204			1,842	435	
Mountain	213	97	30	7,185	7,525		12,775					
Negros Occidental	1,004	602	18,889	55,862	76,357	16,186	26,638			696	14	1,563
Negros Oriental	270	314	199	253	1,036	25	6,440			1,861		16,624
Nueva Ecija	714	245	71	264	1,294		364	30		7,625		
Nueva Vizcaya	156	289	27		472		317					
Palawan	10,444	2,984		26	13,454	414	54			91,152	31,389	306
Pampanga	7	21	115	259	402	498	2,279	165		3		
Pangasinan	1,301	823	206	1,304	3,634	2,054	1,508	26		34,895		
Rizal	33	11	67	818	929	276	10,878	647		8,959	2,316	
Samar	407	287	509	628	1,831	1,474	223		3,290	141,710		1,905

TABLE No. 6.—*Report of the utilization of forest products from public forests of the Philippine Islands during the fiscal year 1916 (January 1 to December 31, 1916)*—Continued.

Province.	Timber.					Firewood.		Charcoal.	Dyewood.	Tan bark.	Dyebark.	Wood-oils.
	Group.				Total.	Class.						
	First.	Second.	Third.	Fourth.		First.	Second.					
	C. meters.	*C. meters.*	*C. meters.*	*C. meters.*	*C. meters.*	*C. meters.*	*C. meters.*	*C. meters.*	*Kilos.*	*Kilos.*	*Kilos.*	*Liters.*
Sorsogon	5,303	2,656	528	3,174	11,661	16,228	29,939	49		29,768	18,800	558
Surigao	334	30	21	102	487	229				84,339		
Tarlac	95	55	17	30	197		96	52		5,078		
Tayabas	3,486	1,265	3,390	3,232	11,373	18,238	17,838	37		70,286		
Zambales	250	66	746	179	1,241	1,236	100	136		1,662		
Total	54,654	32,991	89,428	164,372	341,445	97,856	194,480	2,233	2,381,466	1,543,686	93,057	63,353

Provinces.	Gum mastic.	Gum elemi.	Gutta-percha.	Split rattan.	Unsplit rattan.		Diliman.	Stone.	Lime-stone.	Gogo.	Salago bark.
					More than 2 cm. in diameter.	2 cm. in diameter or less.					
	Kilos.	*Kilos.*	*Kilos.*	*Kilos.*	*L. meters.*	*L. meters.*	*Kilos.*	*Kilos.*	*Kilos.*	*Kilos.*	*Kilos.*
Albay		150		79,234							
Ambos Camarines	123,968	3,998		545,704	177,940	1 740,909	590				
Antique				4,076			3,241				
Bataan	165			94,635	54,460	581,018	1,610			7,853	
Batangas				85						23,911	
Bohol				1			765			6	
Bulacan	324			21,223	4,575	5,663				88	6
Cagayan				280,778	21,607	91,696	2,142				
Capiz	14,786			1,522							
Cavite										858	
Cebu				655			2,225				
Ilocos Norte				800		318			45,780	18	
Ilocos Sur				18,245	17,200			59,387	85,180		
Iloilo				1,541			2,813			124	
Isabela				2,000	39,840	221,400					
Laguna				39,292	5,280	30,200	3,635			308	
La Union									3,000		
Leyte				22,846	8,000	12,700	2,449	45		399	

Provinces.	Gum mastic.	Gum elemi.	Gutta-percha.	Split rattan.	Unsplit rattan.		Diliman.	Stone.	Lime-stone.	Gogo.	Salago bark.
					More than 2 cm. in diameter.	2 cm. in diameter or less.					
	Kilos.	*Kilos.*	*Kilos.*	*Kilos.*	*L. meters.*	*L. meters.*	*Kilos.*	*Kilos.*	*Kilos.*	*Kilos.*	*Kilos.*
Mindanao and Sulu:											
Agusan				58, 485							
Bukidnon				18, 811							
Cotabato			8, 975								
Davao	629, 585			1, 082		185, 900					
Lanao	7, 090		4, 905	180							
Sulu				710							
Zamboanga	116, 474		5, 081	8, 079	1, 290	12, 720					
Mindoro				42, 124	4, 396	42, 550	13, 479			732	
Misamis	8, 019			42, 003			549				
Mountain				47, 468							
Negros Occidental	200	80		188, 684			4, 316			2, 540	
Negros Oriental			80	106, 125			5, 457			1, 940	
Nueva Ecija				27, 004	59, 660	3, 500	280			64, 912	
Nueva Vizcaya											
Palawan	141, 210	250		117, 238	214, 560	430, 235				26, 545	
Pampanga				4, 400	6, 500	56, 700					
Pangasinan	539			2, 546		76, 922				1, 101	
Rizal				46, 927	3, 975	3, 625	676			4, 955	
Samar	335			126, 809			1, 799			735	
Sorsogon	902	4, 715		723, 147	39, 375		7, 450			988	
Surigao				48, 075		99					
Tarlac				2, 486		10, 160	38			11, 048	
Tayabas	45, 951	242, 514	36	398, 908	1, 136, 521	16, 483, 547	6, 614			335	
Zambales				8, 868	90, 000	1, 190, 665				7, 933	
Total	1, 089, 448	251, 657	19, 077	3, 112, 126	1, 884, 679	20, 980, 522	60, 428	59, 432	133, 960	157, 324	6

TABLE NO. 6b.—*Report of the utilization of forest products from registered private woodlands during fiscal year 1916 (January 1 to December 31, 1916).*

Provinces.	Group.				Fire-wood.	Charcoal.	Tan bark.	Gogo.	White earth.	Dye bark.	Rattan.		Diliman.
	First.	Second.	Third.	Fourth.							Kilos.	Linear measure.	
	C. meters.	*C. meters.*	*C. meters.*	*C. meters.*	*C. meters.*	*C. meters.*	*Kilos.*	*Kilos.*	*Kilos.*	*Kilos.*			*Kilos.*
Albay	17.81	88.72	91.88	132.55									
Bataan				6.99	1,066								1,014
Batangas					6,219		337						
Bulacan					6,239								
Capiz	4.54												
Cavite				52.50	1,212	862	10						
Ilocos Norte		6.17	27.05	8.30									
Iloilo					1,768								
Isabela	24.54	15.12		34.28									
Laguna			4.17	174.52	3,889	643	1,890		52,559				
Mindoro	58.00	8.28		5.20									
Negros Occidental	149.12	44.11	304.72	562.58	6,997			51			527		140
Nueva Ecija	107.41	51.83	16.14	111.94	236								
Pampanga		1.12	19.85	447.69	43,599	124							
Rizal	43.29				7,692	165				8,505			
Tarlac	.89	2.26			6,011	21					1,660	422,097	
Total	405.60	167.61	462.81	1,536.50	84,428	1,815	2,237	51	52,559	8,505	2,187	422,097	1,154

TABLE No. 7.—*Minor product licenses in force during the fiscal year 1916 (January 1 to December 31, 1916).*

Provinces.	Firewood.	Charcoal.	Dyewood.	Tan bark and dye bark.	Wood-oils.	Almaciga, resins and others.	Guttapercha.	Bejuco and diliman.	Gogo.	Others.	Total.
Albay	26			5		1		18		1	51
Ambos Camarines	57	2		4		17		117	1		198
Antique								11			11
Bataan	20	7				4		30	5		66
Batangas	7							1		1	9
Bohol	13	1									14
Bulacan	4	10				1		16	1		32
Cagayan	36			5	1	1		54			97
Capiz	33	4			8	7		5		3	60
Cavite	6										6
Cebu	8	4								1	13
Ilocos Norte	7							2		3	12
Ilocos Sur	25			2				17		18	62
Iloilo	72	5	18			2		9	1	10	117
Isabela	6							15			21
Laguna	5							13	2	10	30
La Union	2										2
Leyte	39	2			10	1		30		10	92
Mindoro	27			17				39	7	1	91
Misamis	4			2		7	6	17			36
Mindanao and Sulu	95	14	1	28	1	34	25	49	1		248
Mountain Province	13					1		3		2	19
Nueva Ecija	3							23	27		53
Nueva Vizcaya	4										4
Occidental Negros	87			1	9	7		172	7	47	330
Oriental Negros	11				6	1		41		11	70
Palawan	42		1	53	6	30		52	7		191
Pampanga	3	2						1			6
Pangasinan	17		3	5		1		5	2		33
Rizal	26	3	1	3				18	6		57
Samar	24				2	2		8		1	37
Sorsogon	61	3		6	1	5		81	6	1	164
Surigao	11			3	2			29			45
Tarlac	1					1		3	3		8
Tayabas	67	4		16		36		77	1	4	205
Zambales	10	4		2		5		20	5		46
Total	877	65	24	152	41	164	31	976	82	124	2,536

NOTE.—There was no license issued in the Province of Batanes.

TABLE NO. 8.—*Statement showing the quantity and value of wood and manufactures of wood exported from the Philippine Islands during the fiscal year 1916 (January 1 to December 31, 1916).*

	Quantity.	Value.
Timber:		
United States . . . . . cubic meters . .	771	₱32,832
Hawaii . . . . . do . . .		50
China . . . . . do . . .	190	9,484
Hongkong . . . . . do . . .	413	6,474
Australasia . . . . . do . . .	4	148
Total	1,378	48,988
Lumber:		
United States . . . . . do . . .	14,109	626,354
Guam . . . . . do . . .	11	465
France . . . . . do . . .	3	200
China . . . . . do . . .	15,270	254,828
British East Indies . . . . . do . . .	112	4,916
French East Indies . . . . . do . . .		10
Hongkong . . . . . do . . .	9,255	92,949
Japan . . . . . do . . .	15	1,520
Australasia . . . . . do . . .	1	46
Total	38,776	981,288
Manufactured lumber (furniture, etc.):		
United States		28,235
Hawaii		5,357
Guam		72
Italy		20
Spain		170
Canada		66
China		232
British East Indies		225
Hongkong		424
Japan		520
Total		35,321
All other wood:		
United States		94,136
Hawaii		53
Guam		1,163
United Kingdom		184
Spain		1,806
Canada		38
China		1,624
British East Indies		1,998
French East Indies		210
Hongkong		10,945
Japan		7,174
Australasia		50
Total		[a] 108,875
Total		1,174,472

1 cubic meter = 424 board-feet.

[a] Of this amount, ₱82,100 is the value of rattan exported.

TABLE NO. 9.—*Statement showing the quantity and value of gums and resins exported from the Philippine Islands during the fiscal year 1916 (January 1 to December 31, 1916).*

	Kilos.	Value.
Copal:		
United States	640,564	₱138,845
United Kingdom	81,004	12,674
France	30,000	4,500
Russia	2,815	842
Spain	38,621	6,792
British East Indies	328,600	42,131
Japan	22,334	5,809
Total	1,143,938	211,593
Elemi:		
United States	80,357	36,719
United Kingdom	12,225	4,500
France	600	120
Italy	3,545	1,772
Russia	2,200	660
Spain	4,691	1,913
Hongkong	573	148
Japan	120	20
Total	104,311	45,852
Gutta-percha:		
United States	9,076	10,482
United Kingdom	84	20
British East Indies	20,852	12,396
Total	29,962	22,898
All other:		
United States	13,026	32,151
British East Indies	230	1,568
Total	13,256	33,719
Total	1,291,467	314,062

Table No. 10.—*Statement showing the quantity and value of wood and manufactures of wood imported into the Philippine Islands during the fiscal year 1916 (January 1 to December 31, 1916).*

	Cubic meters.	Value.
Ties for railways	None	None
Timber:		
United States	417	₱13, 387
United Kingdom	1	469
Germany	66	3, 279
China	5	62
French East Indies	6	965
Total	495	18, 162
Lumber:		
United States	11, 311	284, 542
Netherlands		26, 457
China	88	3, 364
German China	23	80
British East Indies	246	4, 847
French East Indies	98	614
Total	11, 766	319, 904
Furniture:		
United States		45, 385
United Kingdom		1, 311
Austria-Hungary		1, 187
France		828
Germany		82
Spain		1, 565
Switzerland		252
China		13, 291
British East Indies		369
Japan		8, 501
Dutch East Indies		20
French East Indies		6
Korea		45
Total		72, 842
All other:		
United States		91, 219
United Kingdom		4, 753
France		1, 734
Germany		1, 986
Italy		23
Spain		2, 178
Switzerland		658
China		48, 752
German China		60
British East Indies		284
Japan		53, 823
Australasia		8
Dutch East Indies		139
French East Indies		394
Korea		91
Guam		34
Total		206, 088
Total		616, 996

TABLE NO. 11.—*Statement of appropriations and expenditures, Bureau of Forestry, January 1 to December 31, 1916.*

Appropriation:		
Act No. 2540	₱308,205.20	
Emergency Board Resolution No. 26	3,000.00	
Total		₱311,205.20
Expenditures:		
Salaries and wages	201,176.77	
Furniture and equipment	4,990.33	
Traveling expenses of personnel	34,401.64	
Rental of buildings and grounds	2,371.81	
Freight, express, and delivery service	1,369.11	
Printing and binding reports, documents, and publications	2,699.95	
Postal, telegraph, and cable service	4,491.57	
Illumination and power service	1,403.88	
Plant and equipment repair service	799.14	
Contingent service	1,363.36	
Consumption of supplies and materials	13,494.51	
Contributions and gratuities	13,722.93	
Total expenditures		282,285.00
Balance		28,920.20
Appropriation for Cebu Reforestation (Act 2649)		10,000.00
Expenditures:		
Salaries and wages	1,266.79	
Traveling expenses of personnel	1,360.82	
Freight, express, and delivery service	44.73	
Postal, telegraph, and cable service	15.64	
Contingent service	2.50	
Consumption of supplies and materials	649.86	
Furniture and equipment	82.75	
Total expenditures		3,423.09
Balance		6,576.91
Appropriation for Forest School building (Act 2494):		
Balance on January 1, 1916	33.96	
Act No. 2583	18,000.00	
Total		18,033.96
Total expenditures		11,964.31
Balance		6,069.65
Appropriation for Agusan reconnaissance (Act 2521):		
Balance on January 1, 1916		284.85
Expenditures		....
Balance		284.85

Statement of Bureau of Forestry appropriations, expenditures, and revenues for fiscal year, 1916.

Appropriations		₱321,205.20
Revenue		494,447.65
Expenditures		285,708.09
Surplus		208,739.56
Percentage of expenditures to revenue	per cent	58

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UNIV. OF

THE GOVERNMENT OF THE PHILIPPINE ISLANDS
DEPARTMENT OF AGRICULTURE AND NATURAL RESOURCES
BUREAU OF FORESTRY

Annual Report of the Director of Forestry of the Philippine Islands

For the Fiscal Year Ended December 31, 1917

ARTHUR F. FISCHER
Director of Forestry

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UNIV. OF CALIFORNIA

ANNUAL REPORT OF THE DIRECTOR OF FORESTRY.

MANILA, *February 25, 1918.*

SIR: I have the honor to submit herewith the Annual Report of the Bureau of Forestry for the fiscal year 1917, covering the period from January 1 to December 31, 1917.

LEGISLATION.

A number of bills were introduced in both branches of the Legislature which directly or indirectly touched upon forestry matters.

Senate Bill No. 136 contained provisions for the protection of fruit trees found in forests. This bill failed to pass, but by inserting its provisions as one of the cutting rules of the timber licenses, it will be possible to protect fruit trees from destruction.

Senate Bill No. 137 provided for Government aid in the establishment of a sugar central for the production of sugar from the sap of nipa. There are large areas of nipa forest in the Philippines under the control of this Bureau.

House Bill No. 911 has been passed by both Houses and guarantees 6 per cent interest upon the capital invested in a mill to produce paper from Philippine products. The bulk of pulp making materials are under control of the Bureau of Forestry.

House Bill No. 1171 was passed appropriating ₱5,000 for the construction of forest stations which will be located at the several mills where scaling is being done. Ten thousand pesos were appropriated for the construction of a road from the College of Agriculture to the Forest School. This improvement is needed as the present road is almost impassable after prolonged rains.

House Bill No. 1197 amending Act No. 2613 contains one item of interest to the Bureau of Forestry. It extends the time in which tobacco growers can secure free timber for the construction of tobacco curing houses.

House Bill No. 869 failed to pass. This bill proposed to exempt from forest charges Sibucao (Sapan wood) and firewood secured from unregistered private lands.

PERSONNEL.

Several changes were made in the technical personnel of the Bureau this past year, due to much greater opportunities being offered to technical men by large companies and foreign governments bidding for their services. The most important resignations were those of the chief of what was formerly the division of forest management, one district forester, the chief of the division of administration, one field assistant, and the chief of the division of investigation and professor in charge of the Forest School, all of whom were Americans and exceedingly valuable men with years of experience in the Philippines. It was thought that the exodus of these responsible technical employees would impair the efficiency of the Bureau, but to counteract the possible embarrassment, other arrangements were made to accomplish the work. The first one mentioned above resigned to enter the employ of a private company in China at an increased salary and is doing much toward creating a market for Philippine woods in China. The second, who was in charge of the Forest School and division of investigation during the vacation of the chief, accepted a position with a large rubber company in Sumatra at a much better salary and greater privileges; credit is due him for inaugurating and outlining the work of reforestation for the Bureau, part of which was considered in last year's report. The chief of the division of administration, initiator of the Filipinization of clerical positions in the Bureau and reorganizer of the entire office procedure, accounting, etc., not only increasing efficiency but resulting in proportionately large economy, accepted a position with a private concern in the United States at double his salary. The fourth, considered by the Bureau the best field man it ever had along lumbering lines, has gone into business for himself with assurances that he will make at least four time his salary. The fifth, chief of the division of investigation and professor in charge of the Forest School, a man of wide reputation along scientific forestry lines, to whom the Bureau owes much for its scientific data, and with more than eleven years service in the Philippines, took advantage of the Retirement Act and accepted a position as forest research officer for the Federated Malay States, with much better privileges than he was receiving in the Bureau.

Six rangers resigned during the year, one of whom accepted a better position in the Borneo Forest Service, and another a better paying position with the Kolambugan Lumber and Development Company; the others wished to continue their education. One ranger was dropped for unsatisfactory service and another for overstaying his leave. Another ranger transferred to the Bureau of Education. The following appointments were made during the year: twenty-one rangers graduated from the Forest School; 8 clerks; 2 messengers; 1 American forester reinstated and 1 lumber inspector. Some of the new clerks and messengers were to fill vacancies due to the changes in the office caused by retiring employees. The permanent force on January 1, 1918, consisted of: one Director, 1 lumber inspector, 7 foresters, 1 instructor in forestry, 1 wood expert, 1 field assistant, 2 assistant foresters, 118 rangers, 5 draftsmen, 31 clerks, and 1 messenger, besides the following employed on a temporary status: one nurseryman, 1 draftsman, 11 laborers, 1 carpenter, 1 varnisher, 38 guards, 2 watchmen, 2 janitors, 1 chauffeur, 1 launch engineer, 1 launch patron, 1 launch sailor, 1 telephone operator, and 2 messengers, making a total of 233 employees.

ORGANIZATION.

It has been found necessary to make a general revision of the divisions of the Bureau of Forestry and, owing to the use of the word "Administration" throughout the Government service to indicate the work of the office of the chief clerk, the term forest management was adopted for the former division of administration. The land classification work of the Bureau has constantly increased in volume and importance and all such work has been turned over to the division of forest lands and maps, while all the large twenty-year license agreements and sawmills and the work in connection therewith were placed under the division of sawmills and utilization, taking over practically all the work of the former division of forest management. No material changes were made in the division of investigation.

The undersigned is pleased to state that these changes have resulted in clear-cut lines of work and have done away with friction, duplication of work, and divided responsibility.

EFFICIENCY.

The field work has been done as in the past, with the exception that special corps of rangers are being built up for specialized work, such as reconnaissance crews attached to the division of forest lands and maps. These men are trained to do special work in relation to reconnaissances, forest zones, reserves, etc., where land questions are always included to a greater or less extent. A body of investigative rangers was partially formed, but due to lack of personnel for the district ranger force, this crew was disbanded for the time being.

As the work of the Bureau along all lines is increasing very greatly and becoming year by year more detailed, while the lack of sufficient field personnel is still felt, methods had to be devised to keep up the work without loss of efficiency and promptness; this has practically been solved by a revision of forms and by substituting forms for the monthly reports and in general by doing away with as much red tape as present conditions would allow.

All cases which involved special work are arranged in the central office and the rangers instructed accordingly. Responsibility for efficiency and economy rests with the division of forest management more from precedent than from the importance of the work, leaving the chiefs of the other divisions free for other work.

Transfers of rangers, disciplinary measures, and recommendations for promotions are acted upon by a "Personnel Committee" composed of the chiefs of divisions and the inspectors in the Manila office.

FORESTS AND THE MINING INDUSTRY.

With the increase in the development of mining, a situation arose in which the Bureau had to take decisive action so as to make timber available for legitimate mining operators who were being handicapped by being forced to pay beyond reason for timber, or by being placed in a position of having to buy claims with standing timber to prevent shutting down for lack of it. The situation as a whole is not serious at the present or discouraging for the future, but is rather the natural result of the first stages of development of new mining districts and can easily be handled by the initiation and enforcement of a just and legal forest policy. The policy of the Bureau has been very liberal toward the mining industry, but this policy was based on the good faith of the prospector and miner. The mining law not being enforced, assessment work not being done and relocation practised year after year, it is obvious that the forest policy in regard to mining could not be what it should have been, because of lack of information in the hands of the Government and the entities having charge of mining as to the condition and status of claims for which miner's timber licensees were requested. It was obvious that the first necessity, before anything definite could be done, was information and, for this purpose, parties were sent out to the various mining regions to make reconnaissances, mapping claims, the vegetation and stands of timber in the vicinity.

In the Benguet district, the demand for timber was keenly felt, which caused practically all of the accessible forests to be staked as mining claims for the sake of the timber which was held at constantly increasing prices as the timber demand increased. A majority of the claimants were actuated by no other motive than to protect their legitimate mining interests by attempting to secure for themselves a supply of timber sufficient to develop their property, but there are a few notable cases where the purpose is not so justifiable, as it was very evident that the claims were staked for timber only, with the intention of profiting thereby by disposing of mining timbers to active miners and prospectors who had been debarred from the public forests by the wholesale blanketing of the surrounding country with so-called mining claims.

As soon as enough information was at hand, the undersigned immediately instituted much stricter control over all timber in mining districts on unpatented claims and surrounding forest lands, keeping in mind and aiding as much as possible the mining industry, with special reference to maintaining a future timber supply for mining development and domestic requirements, as well as keeping in mind the watersheds, to prevent floods in the wet season and diminished water supply in the dry season.

Due to the Bureau not being able, as mentioned above, to obtain the necessary information on mining claims from the other Government entities having charge of them, for the proper control of the issuance of licenses to miners, and the field personnel not having the necessary technical education or authority, it was indispensable to devise means of obtaining the needed information. The undersigned therefore visited the mining region around Baguio, studied the situation and conferred with the miners. As a result, the Benguet Miners' Association was reorganized and now, whenever any person applies for a license within the mineral region, his application is informally referred to the Association for comment and recommendation. As a committee of the Association goes into each case very thoroughly, the Central Office, knowing the view point of the industry as a whole, can act intelligently on each case. During the year, the Benguet Miners' Association has loyally coöperated with the Bureau of Forestry in protecting and using conservatively the existing forest. The miners are also coöperating in reforesting the stripped watershed.

The Paracale field is practically all placer claims and the dredges use thousands of cubic meters of firewood every year. The claims that are being dredged do not furnish all this firewood and it will be necessary to use the highland forests more extesively than in the past. Field parties of the Bureau have covered this region and have gathered information which will allow the intelligent administration of the forests for the industry. The Aroroy field in Masbate has also been covered by field parties of this Bureau and like information gathered. Field parties have likewise studied and reserved areas of timber in and about the most promising coal deposits to assure timber for future development.

On the whole, the relations of the miners with the Bureau of Forestry have been cordial and the only causes for friction have been due to misunderstanding the jurisdiction of the Bureau of Forestry. An effort will be made to bring the new Forest Regulations to the attention of every miner.

REFORESTATION.

In several districts considerable interest has been aroused in reforestation.

In those regions in which no timber is found, more particularly the Ilocos coast and southern Zambales, the people are taking an active interest in reforestation. Several municipal presidents in La Union, Ilocos Norte, and Ilocos Sur have requested help in establishing forest plantations or in planting timber trees in their communal forests. In Zambales, the residents of the district from San Antonio to San Felipe are obliged to go from 10 to 15 kilometers for firewood and the municipal officials are ready to coöperate in planting cogon hills near their towns with ipil-ipil seed. Some seed has already been secured, but owing to there being no fund for this purpose only such work was undertaken as means permitted.

Additional data has been secured regarding ipil-ipil and the Bureau of Forestry is now in a position to recommend the planting of ipil-ipil by farmers who are obliged through necessity to make caiñgins. It is hoped that the non-Christian tribes who now make clearings in valuable forests can be induced to confine their operations to ipil-ipil areas. A regular rotation system is being followed by farmers in Laguna, Panay, and Cebu, who cultivate successive patches of ipil-ipil, and there is no reason why others who have no work animals cannot do the same.

In Benguet, owing to lack of funds, no extensive work has been undertaken although, in coöperation with miners, 14,000 shrubs were set out at the head of Antamok Creek, Baguio, for the purpose of protecting the watershed and killing grass. If grass fires can be prevented there will soon be an abundant crop of pine seedlings springing up. However, unless energetic measures are taken soon, there will be a scarcity of timber in certain sections of Benguet.

The report of 1915 contained a detailed account regarding the reforestation work being carried on at Cebu. This work has been continued with success, 971 hectares having been planted during this past year. There was some opposition from certain squatters who believed that they owned the land, although it was a friar land estate, but when they realized that they had no right to the same, they moved to other regions or helped in the planting.

Several individuals have taken an interest in reforestation work, notably two farmers in western Pangasinan who furnished laborers to replant a deforested valley from which they had formerly secured water to irrigate their fields. Three sugar cane planters in Negros have also furnished laborers to plant firewood on cogon hills in order to secure enough fuel for their cane mills.

DIVISION OF FOREST MANAGEMENT.

DUTIES.

Upon the reorganization of the divisions of the Bureau, the former division of administration was renamed the division of forest management. The chief of this division is a forester with seven years experience in Philippine forestry work and he is charged with the general supervision of all the field men, the protection of the public forests, and the sale of forest products. All matters involving the disposition of land or surveying have been transferred to the division of forest lands and maps.

By this arrangement, the chief of the division of forest management has more time for special features of his work which demand solution if the forests are to remain an asset of the Philippine Islands.

NEW FOREST DISTRICTS.

Two new forest districts were established in 1917, thus making fourteen in all. The district serves as an administrative unit and whenever the development of roads or improvements in mail service make it necessary, the provinces and islands comprising the districts are rearranged.

District No. 12, Mindoro Island, was divided into two subdistricts, each reporting dircetly to Manila, because there was no regular steamship service between the northern and southern end of the island.

District No. 13 comprises Cavite and Rizal Provinces with its headquarters at Manila. The need of such a district had been felt for some time and the results have justified its establishment. Not only do the men assigned to this district perform their usual duties, but they are available for special service. Another advantage is that local licensees who, in the past, always came to Manila to transact their business can do so directly with the district force.

District No. 14. In forming this district, advantage was taken of the steamship lines radiating from Cebu. Nearly all the territory dependent upon that port as a distributing center has been included in this district. It contains the following provinces: Cebu, Oriental Negros, Bohol, and Agusan.

INSPECTION.

More district headquarters and forest stations were inspected during 1917 than in the preceding year. The undersigned visited districts 2, 3, 4, 5, 7, 8, and 10 and districts 6 and 11 were inspected by men from the Manila Office.

The work of inspection will be continued as the special problems of each station can be solved to better advantage by a conference than by correspondence. Another advantage is that the Central Office is in more intimate touch with the field force and can thus secure greater efficiency and better coöperation.

SUPERVISION.

To supplement the work of inspection, an experienced ranger examines all license-inspection reports, diaries, expense accounts, and working programs and makes the proper entries on cards. These cards are ruled into columns, thus providing space for the different lines of work performed by rangers. The efficiency of the field force can thus be kept up, but certain shortcomings have developed which it is hoped will be solved by the use of a revised monthly report which shows both the amount of work performed daily and that still pending at the end of the month.

LICENSES.

The Bureau of Forestry authorizes responsible persons to cut specified forest products in a definite area under such restrictions as may be necessary to perpetuate the supply of forest products.

The licenses and permits now in use are: License agreements for a term of not more than twenty years, ordinary licenses, special use permits, miners' licenses, gratuitous licenses, and tobacco curing house licenses.

No fees are charged for these papers and all forest charges are fixed by law or, in the case of minor products such as rattan, bark and resins, by the Director of Forestry and Collector of Internal Revenue and are then published in the Official Gazette.

The license agreements are contracts whereby the license is authorized to operate for a term of years. Reforestation or conservative management of the forests is one of the requirements if the forest is not on agricultural land.

The gratuitous licenses are issued to individuals who need first-group timber for erecting a "strong material" house, that is, one having wooden walls and floors as distinguished from one made of bamboo or nipa. Gratuitous licenses are issued to public officials for securing timber for public works. Miners also receive gratuitous licenses to cut timber upon their claims.

A miner's license authorizes a miner to secure public timber for development work at half the ordinary rates.

Special-use permits authorize the use of public forests or the securing of forest products in accordance with the terms stated in each permit. The greatest demand for these permits is from those who intend to make ponds in tidal swamps for raising fish.

The tobacco curing house license is issued only to tobacco growers who want free timber in order to build a properly designed tobacco curing house. This work is under the close supervision of inspectors of the Bureaus of Agriculture and Internal Revenue, who are also authorized by the Director of Forestry to issue these licenses.

LICENSE STATISTICS.

Ordinary timber licenses increased more than 300, there being a total of 1,906 in force. This does not include those which were returned or canceled. There was, however, a decrease of 262 in the number of gratuitous timber licenses issued, the total being only 1,783.

In the minor forest products, 3,473 licenses were issued, an increase of 937. The greater part of this increase was divided, almost equally, between firewood and rattan, these two forest products being in such a demand that they commanded almost double the prices ruling in ordinary years.

Tables Nos. 5 and 7 in the appendix show in detail the licenses issued during the year.

OFFENSES OF LICENSES.

The offenses committed by licenses can be divided into two classes, namely, those acts which involve loss of revenue to the government and those which are a disregard of the instructions intended to perpetuate the forest resources.

Under the first heading comes selling forest products before forest charges have been paid and also the securing of forest products without license. Only close supervision will prevent the sale of products and if a licensee fails to improve his methods, the license is not renewed or is canceled.

The disregard of cutting rules is due to an inherent fault of the short term license system and to the lack of supervision by the licensee over the operations in the forest. A license is issued for only a year and, therefore, the licensee does not have the same interest in it as if he had a long term license. The lack of supervision by the licensee is most noticable in the case of those who merely secure a license and then collect fees from these who want to cut timber. The licenses of such offenders are promptly canceled when over there is sufficient evidence to warrant it.

Another form of violation is frequent, namely, the cutting of small first-group trees for special purposes. There are a number of durable trees in the lower groups which will serve equally well, but licensees persistently cut small trees as they are readily salable, thus depleting the supply of growing first group timber.

The lack of responsibility of a licensee is shown most conspicuously in firewood operations, where the usual practice has been to make contracts with firewood cutters, who then cut whatever they please regardless of any prohibition that may have been made about cutting trees that are smaller than a specified diameter.

OFFENSES OF NONLICENSEES.

It is the nonlicensee who fells seed trees, cuts small timber, steals products secured by others and makes trouble for all legitimate forest users.

If an unauthorized person operates within the area of a licensee, the products so cut can be confiscated and delivered to the licensee. If he operates in an unoccupied public forest, he is comparatively safe, for, if his allegation that he is cutting for personal use fails to justify his operations, he merely pays double the ordinary charges.

FUTURE WORK.

During 1918 the tidal swamps will be put under systematic management as rapidly as they are surveyed. Other forests and forest products will also be studied in order to handle them conservatively. The production of gutta-percha, wood oil, gum copal and other resins, also rattan, palm products, and upland firewood need to be put under some form of management which will not put a premium on clear-cutting the forest.

If the funds permit, greater efforts will be made to coöperate with municipalities in planting firewood species on waste land.

CAIÑGIN DEFINITION.

The term "caiñgin" is used to designate a primitive form of agricultural operations involving forest destruction and usually temporary occupation of the cleared land.

REDUCTION IN NUMBERS.

The number of caiñgin cases reported shows a decrease and the number of successful prosecutions is much larger than was the case in 1916. The decrease in numbers is due to several factors. Bountiful crops in many parts of the Islands made it unnecessary for farmers to clear additional land. The publicity given by forest officers to the advantages of acquiring land under the homestead sections of the Public Land Act has tended to reduce the illegal occupation of public land. Another reason for there being fewer caiñgins is that definite areas of brush land were set apart and cleared under a general permit, thus giving the people an opportunity to raise food without destroying forests.

Caiñgin reported during the fiscal year 1917, January 1 to December 31, 1917.

Province.	Reported by—		Total.	Acted on.		Total.
	Forest officer.	Municipal president.		Convicted.	Acquitted.	
Abra						
Albay	78		78			
Ambos Camarines	63		63	22	2	24
Antique						
Bataan	8		8	8		8
Batanes						
Batangas						
Bohol	3		3			
Bulacan	21		21			
Cagayan	36		36	1		1
Capiz	29		29			
Cavite						
Cebu	13		13	2	2	4
Ilocos Norte	9	1	10			
Ilocos Sur	14		14			
Iloilo	1		1	7		7
Isabela	11		11			
Laguna	34		34	3	1	4
La Union						
Leyte	45	2	47	49	14	63
Mindoro	36		36			
Misamis						
Department of Mindanao and Sulu:						
Agusan	1		1			
Bukidnon						
Cotabato	1		1			
Davao						
Lanao						
Sulu						
Zamboanga	8		8	8	2	8
Mountain Province	8		8			
Nueva Ecija	19		19	6	6	13
Nueva Vizcaya	5		5	5		5
Occidental Negros	28		28	72		72
Oriental Negros	1		1			
Palawan						
Pampanga	2		2			
Pangasinan	17		17	2		2
Rizal						
Samar	22		22	36	18	54
Sorsogon	76		76	35	12	47
Surigao	8		8	31		31
Tarlac						
Tayabas	56		56	32	3	35
Zambales	9		9	4		4
Total	662	3	665	321	60	381

The reason more cases were successfully prosecuted was due to the greater experience of the rangers, as well as care in presenting the facts at the trial.

CAUSES FOR CAIÑGIN MAKING.

Caiñgins are made either through deliberate disregard for the law or because of dire necessity. The Bureau of Forestry has, from the first, recognized this distinction, as may be noted in the forest law, which provides that members of non-Christian tribes shall be warned for a first offense. Those who make caiñgins regardless of law and for the sole purpose of acquiring land usually have the support of influential persons in town who share in the crop and eventually claim the land.

The persons who make caiñgins through necessity are either non-Christians or else farmers who, through the lack of work animals, are forced to clear forest land in order to raise food.

THE CAIÑGIN MENACE.

The making of caiñgins cannot be called a development of the country as was the case in the United States, for in the vast majority of clearings only one or two crops are raised. After that, the presence of cogon grass (*Imperata exaltata*) with its matted roots makes further planting impossible unless the land is plowed. It is, therefore, obvious that a farmer without work animals must make another clearing. This has gone on for centuries, until now 40 per cent of the land area of the Philippines is covered with nonproductive cogon.

Persons who have made a caiñgin believe that they have secured a title to it when they have been prosecuted, for they continue to enlarge their clearing and thus present a very difficult problem as no law seem to be applicable to their case.

THE REMEDY FOR CAIÑGINS.

The only way to reduce the number of caiñgins made to acquire land is to continue the propaganda now being carried on by forest officiers. They emphasize the evils of forest destruction, explain the homestead system of acquiring land and, what is more, aid the homesteader in preparing his application. More stringent laws dealing with forest destruction and one punishing unlawful occupancy of public land would do much to discourage this practice.

As for the second class of caiñgin makers, the Bureau of Forestry has a remedy. As has already been explained under the topic "Reforestation," the clearing of thickets of ipil-ipil will permit habitual caiñgin makers to raise crops and gain a living without becoming law breakers.

FOREST DISTRICT REPORT.

Only the striking features of the work in each district are mentioned in the following summary, as the usual work of examining lands, inspecting forests, enduring hardships and the high cost of living are common to all districts.

District No. 1.—Lumbering as in the past, depended upon the ability of lincensees to market their output. These licensees who were near the coast or could secure cargo space were active. The provincial government mill in Nueva Vizcaya supplied local needs and also furnished timber for public works in Isabela.

Complaint was made by timber licensees that certain brokers in Manila are too liberal in discounting defects. One man in particular stated that 40 per cent of a shipment of sound Narra had been rejected for fancied defects. Others claimed that on an average, 30 per cent of each shipment is deducted by Manila buyers. This is a long standing abuse which can only be remedied by concerted action on the part of responsible lumbermen and the establishment of Government inspection in cases of dispute.

The price of baling rattan was nearly doubled; it was selling at ₱9 in December instead of at ₱5.50 as normally. Almaciga (gum copal) was exported for the first time and guano and red ochre deposits were being developed.

There was no appreciable change in the number of licenses issued. The amount of homestead work increased because of the addition of Nueva Vizcaya to the district.

The prosecution of caiñgin cases was very successful and the cases brought to trial shows an increase. Only three caiñgin permits were issued and two hundred other applicants for permits were induced to homestead the land.

Eight parcels of communal forests were located for different towns.

The forestry exhibit at the First Annual Tobacco Exposition of Isabela was most instructive and the first prize was received.

For better administration, two new forest stations were established, namely, at Tuguegarao and Echague, and four guards were employed who were instrumental in collecting forest charges amounting to over ₱3,000 on timber which had been cut without license.

District No. 2.—There has been practically no change in the number of lincenses in force. As for public land reports, 192 were pending due to a ranger having left the district in June and not being replaced. Many reports were received in November and December too late for inspection during the year.

The caiñgin situation was favorable. The majority of the clearings found were confined to alleged private land. The "Food Production Campaign" has resulted in an increased demand for caiñgin permits and to simplify the issuance of permits, clearings were authorized in restricted areas which were to be homesteaded or planted with ipil-ipil. The sawmill at Burgos was not operating during the year owing to the absence of its manager.

District No. 3.—The chief work of the district has been marking trees for various licensees and setting aside pasture areas for these grazing stock in order that indiscriminate grass fires within forest areas may be controlled.

The marking of trees is necessary, as otherwise no seed trees would be left. Further, unless there was some supervision, trees upon private property would be destroyed by irresponsible firewood cutters. By the leaving of seed trees and by the prevention of grass fires, a start has been made in restocking limited areas with pine seedlings. Unfortunately, a single grass fire will undo the work of several years, therefore reforestation by means of seed trees is slow.

Owing to the provision of the forest law which acquits non-Christians for the first offense of destroying trees, it was necessary to prosecute a number of Igorots under a municipal ordinance which forbids the cutting or damaging of trees within the limits of Baguio. The effect was beneficial, as the number of requests to mark trees increased.

The Benguet Miners' Association has coöperated loyally with the forest officers in managing forests in the vicinity of the mines.

Nursery work was carried on as in the past. Thousands of trees and shrubs were distributed or planted.

District No. 4.—There was a considerable increase in the cutting of timber due to two reasons, namely, to the demand which usually follows a bountiful harvest and also to the establishment of a shipyard at Bolinao, which affected licensees in western Pangasinan. About one hundred more licenses were issued in 1917 than in the previous year.

There is a great demand for firewood and it is very urgent that mangrove swamps be put under systematic management, as it has been found that the cutting rules designed for their protection are not sufficient to accomplish that purpose. A licensee may obey the instructions contained in his license, but the government does not derive any benefit from his doing so because other licensees or irresponsible firewood cutters invade his area and cut clean.

The "Food Campaign" has increased the number of homestead applications; 1,200 more applications were received during 1917 than in 1916. A great many of these homesteads required careful inspection due to their proximity to the forest.

Communal forests are not accomplishing the object for which they were established.

The number of caiñgin cases reported has fallen from 52 to 9. This is due to the coöperation of the licensees, who realize that their business is dependent on the existence of the forest. Moreover, persons who wish to make caiñgins are better informed regarding the law and they now apply for homesteads.

The changes of the district as announced last year have proven to be advantageous. Unfortunately, due to the lack of personnel, it has not been possible to maintain a ranger at Masinloc throughout the year. It has therefore been necessary to make long trips from Dagupan to the west coast of Zambales.

District No. 5.—The addition of southern Tayabas to the district has added more territory, but no new problems. The work of the previous years in dividing the forests into compartments suitable for the operations of small licensees is of great value to the district, as this system not only facilitates the granting of licenses, but it also shortens the trial notes which may be taken for other purposes, as there are a large number of known points throughout the district. The compartment system will be extended to southern Tayabas as rapidly as possible. In fact, the reconnaissance of this region, which is now in progress, is the beginning of this work.

Owing to the good prices obtained for abaca (Manila hemp), considerable building has been going on. The timber licensees are prosperous and three of the mills in the district have been doing a good business. The Tayabas Sawmill Company has been reorganized under the name of the Philippine Lumber Company and is now being operated by Filipino capital.

The "Food Production Campaign," here as well as elsewhere, has been seized upon as an excuse by certain individuals for making caiñgins.

The lack of personnel is strongly felt. Additional rangers and guards are needed in order to control the cutting of firewood, which at the present time is the chief forest industry of this district.

District No. 6.—The high prices obtained for abaca created a great rush of labor to the hemp plantations and, for this reason, many of the small licensees were obliged to reduce their operations. Licensees operating on the Pacific coast of this district have been seriously handicapped by lack of transportation. As a result, the lumber dealers of Legaspi have had difficulty in meeting the local demand and their yards are usually empty.

The number of caiñgins made in the district has not decreased. The greatest difficulty about caiñgin making is among the hemp planters who make small clearings in the forests and then from year to year girdle the larger trees in the adjacent forest and thus extend their hemp plantation. As this is a gradual process and does not involve clearing of the land, the discovery of such clearing is exceedingly difficult, as a person's vision when going through a hemp region is limited.

The most important line of work to be undertaken during the year is the establishment of a forest zone around Mount Isarog in order to limit the hemp plantations, which are now extending up the slopes, and thus maintain the remaining forest for the protection of irrigation works in the surrounding country.

District No. 7.—Lumbering has been active throughout the district, as shown by the numerous requests from licensees for additional amounts of timber.

A violent flood for a time interrupted lumbering at Fabrica and Cadiz, but the chief obstacle met with by all licensees was the lack of shipping.

The fuel situation is a serious problem. Some mangrove swamps have been stripped of all firewood and therefore will not be in a productive condition for years to come. Careful management of the tidal swamps will prevent destruction, but it will not relieve the fuel shortage. As far as possible, the firewood licenses have been given to persons needing fuel and speculators have been eliminated whenever found.

The rangers coöperated with several sugar-cane planters in Negros who have planted ipil-ipil on abandoned land near their sugar mills. The ipil-ipil will not only furnish fuel, but will also enrich the soil which had become exhausted.

There have been many important cases in court over the registration of forest land in which the rangers successfully proved the validity of the Government's claim to the land.

District No. 8.—The mills in Mindanao have been very busy on Government contracts, both military and civil. They have also several fair sized shipments to China and a trial order to Australia. Transportation facilities have improved because the confiscated German ships carry lumber cargoes.

The propaganda of the rangers regarding caiñgins and homesteads has had favorable results and the number of homestead applications has increased and the number of illegal caiñgins in the forest has decreased.

The investigation made by the chief, division of investigation, regarding forest resources, especially minor forest products, in the provinces of Bukidnon, Davao, and Cotabato, has been of material assistance to this district.

Owing to market conditions, only the most salable minor forest products were gathered. The chief of these are almaciga, gutta-percha, rattan, firewood and tanbark.

The work in establishing communal forests is progressing slowly because of the enormous extent of the municipalities. Before announcing the establishment of a communal forest for a town, it is necessary to locate a parcel for practically every barrio, as it would be unfair to establish a communal forest unless al sections of the municipality can be benefited thereby.

District No. 9—A new station was established at Coron in order to facilitate the work in the northern part of this district. Lumbering conditions have been improved during the year because, in addition to a steamer which calls at ports on the east coast, two auxiliary schooners make trips to the west coast.

Cattle owners have caused some friction among the people by closing trails and excluding homesteaders from the land that they have applied for. This trouble is now being adjusted by the Bureau of Lands.

The forest officers have been coöperating with the provincial authorities regarding the settlement of agricultural regions by the mountaineers. Noncommercial forests have been set aside for their use, as these people are compelled to depend upon the caiñgin system of agriculture for their crops.

Inspection work is very difficult because of the lack of trails along the coast. All coastwise travel is either in a steamer that calls at irregular intervals or by means of small dugout boats which cannot venture out if the surf is high. Unlike other parts of the Philippines, both the northeast and southwest monsoon sweep along both coasts, thus making traveling in a small boat difficult at all times.

District No. 10.—Lumbering has been up to the average throughout the district, but the scarcity of ships in Masbate and the prevalence of rinderpest in Leyte retarded operations in those provinces and, as a result of this and the demand for labor in abaca (Manila hemp) fields, the price of lauan lumber rose from ₱50 per thousand board feet to ₱70.

More field notes have been taken in this district than in any other because of the systematic effort made to secure data regarding remote forests.

District No. 11.—The portion of Nueva Ecija which was formerly in district No. 11 was transferred to District No. 4, which made the district more compact than formerly. There has been little change in the relative number of licensees or in the output of lumber. There is, however, a great demand for firewood, with the result that every available area is being utilized. Efforts are being made to reduce the amount of illegal cutting in Bataan. Owing to the constant demand for bancas around Manila Bay, it is very profitable to manufacture bancas and illicit cutters find a ready market for their wares once they are removed from the forest. It is hoped that by issuing permits to the banca makers, it will be possible to reduce the amount of illegal cutting. It seems that the restrictions imposed by certain licensee upon their laborers make it unprofitable for individuals to lawfully engage in the business of making bancas.

A detailed study has been made of the mangrove swamps and nipa plantations and also of fishponds in Pampanga, in order that the Bureau of Forestry may establish a uniform policy in the management of public mangrove swamps.

Throughout the greater portion of the district, caiñgin making in public forest has almost ceased. The Negritos are confining their operations to tracts of land which had been set aside for their exclusive use and, in other regions, the patrol maintained by guards and talks given by rangers have been sufficient to reduce further forest destruction to a minimum.

As many firewood licensees are cutting upon nonagricultural land close to the beach, an effort will be made during the coming wet season to supply all of them with ipil-ipil seed in order that they may stock their areas with trees. If this is not done, the probabilities are that the cut-over land will be covered with cogon.

District No. 12.—Early in July, District No. 12 was divided into two parts because of the poor mail facilities between northern and southern Mindoro. There has been no notable increase in the amount of timber cut, but the firewood cutters have been very active.

The provincial government of Mindoro has started a project in behalf of the Mangyans, a tribe of mountaineers. In order to encourage these people to settle down in villages where they can be educated, the government has established trading stores at which they can exchange forest products for their needs. To facilitate this enterprise, minor product licenses have been issued to the provincial treasurer. Forest officers have also designated suitable tracts of land in the vicinity of the stores, which these people can cultivate.

There has been a great influx of settlers from Panay and Luzon, with the result that caiñgin making is still very prevalent.

The cadastral survey in the vicinity of Calapan has kept a ranger busy looking after the interests of this Bureau.

District No. 13.—The officer in charge of District No. 13 was absent on leave for a considerable period, but the other ranger kept up the work, which consisted chiefly in looking after firewood licensees, inspecting homesteads and areas which were to be cleared.

He was also sent on special trips by the undersigned when the personnel of other districts needed assistance.

District No. 14.—In order to take advantage of steamship service out of Cebu, a new district was established, known as District No. 14. Agusan, formerly in District No. 8, Negros Oriental, Cebu, and Bohol of District No. 7, were united to form this district. The officer in charge and two of the rangers were detailed in June and since then, they have made detailed examinations of mangrove swamp areas in northern Bohol.

The fuel shortage has led to prospecting for coal and three new coal beds were found near the Cebu–Toledo Road. One of these is being developed by a timber licensee. The rangers, on their part, are doing what they can to induce sugar cane planters to raise their own firewood on waste lands near their mills and thus reduce the demand for mangrove firewood.

DIVISION OF FOREST LANDS AND MAPS.

ORGANIZATION.

Because of the considerable increase of work in connection with subjects pertaining to both public and privately claimed lands, it became necessary to establish this division in order to take over from the former division of administration all those subjects which affect the legal status of forest lands. All other work regarding personnel and the handling of forest products was charged to the Division of Forest Management.

The different subjects pertaining to forest lands were divided among the following sections:

Public forest lands cases.
Private forest lands register.
Public lands applications.
Forest reconnaissance.
Forest zones, reserves and communal forests.
Mapping and drafting.

PUBLIC FOREST LANDS CASES.

This section is charged with receiving from the General Land Registration Office all notices of court proceedings for the registration of lands claimed as private property, and prepares the necessary information regarding the character of the soil and vegetation in order to decide whether it is or is not advisable for the Bureau of Forestry to take action in opposition to the claims.

The following table shows the status of the claims received during 1917:

Number of notices of hearings.

	Number received.	Action taken.	No action necessary after inspection.	Pending decision of court.	Adjudicated to the Insular Government.
					Hectares.
Cadastral	10	4	1	1	775, 73. 32
Ordinary	999	114	59	32	171, 92. 65
Grand total	1,009	118	60	33	947, 65. 97

Since the Bureau of Forestry established a more exacting system in the examination of this class of lands, the practice of applying for their registration without any title other than the very doubtful right of occupation has notably decreased, as may be seen from the great difference of the area which was adjudicated to the Government in 1916, 20,400 hectares, against 948 hectares in 1917.

FOREST LANDS REGISTER.

It is the duty of this section to examine the legality of titles or documents which are submitted as evidence of ownership for their inscription in the Bureau of Forestry, in accordance with section 1829 of the Administrative Code, and also to secure all information regarding the character of the land. These data are forwarded to the Collector of Internal Revenue, together with the approximate data of the forest area and species and quantity of timber and other forest products, in order that the owner may use his woodland without hindrance.

The following table shows the private woodlands registered up to December 31, 1917.

Registered private woodlands.

Calendar year.	Number of—			
	Parcels.	Hectares.	Ares.	Centares.
1900	420	20,643	68	51
1901	201	68,386	06	95
1902	23	16,412	27	44
1903	3	1,305	94	65
1904	8	29,228	47	82
1905	12	6,631	68	89
1906	21	12,796	95	24
1907	17	28,338	73	05
1908	10	535	97	53
1909	14	6,215	86	62
1910	4	8,653	85	22
1911	5	533	67	26
1912	14	6,552	34	89
1913	26	15,229	58	36
1914	16	23,290	05	07
1915	27	18,304	36	95
1916	37	51,663	77	49
1917	48	7,985	68	39
Total	907	317,587	95	33

PUBLIC LANDS APPLICATIONS.

This section is charged with recording all requests forwarded by the Bureau of Lands for certification as to the agricultural or forest character of land applied for by settlers, a duty which was imposed on the Bureau of Forestry by the Congressional Act of July, 1902. It distributes the applications to the different forest stations for the necessary examination of the land, studies the reports submitted by the examining officers and prepares the agricultural or forest certificate for the Bureau of Lands.

The same conditions and difficulties, or probably greater difficulties than those mentioned in previous reports, existed during the year, and for this reason this Bureau maintains more strongly than ever the opinion that the Government should restrict the occupation of agricultural lands to surveyed tracts instead of permitting private individuals to choose arbitrarily the separate parcels for which they wish to apply.

The table in the appendix shows the distribution of applications in the different provinces of the Archipelago, the summary of which is as follows:

Applications on hand during 1917		13,014
Certified for agriculture	8,207	
Certified for forestry	830	
Returned uncertified	174	
		9,211
Total pending December 31, 1917		3,803

FOREST RECONNAISSANCE.

This section, composed of especially trained forest officers, is charged with all field and office work regarding forest reconnaissance, which is a necessary prerequisite for the proper administration and utilization of the areas set aside for forest purposes. For example, the industries, whether already established or proposed, that depend on forest products need more detailed information regarding the forest resources and the methods of exploitation best fitted to assure a continuous supply of raw material for such industries.

The mining industry is the one which is most likely to suffer from the effects of an unrestricted use of the forest resources, as well as certain other industries which, due to the high cost of coal, depend on the forests for fuel.

At the request of the interested parties, and in some cases on its own initiative, the Bureau of Forestry carried out during 1917 the following reconnaissances:

1. Mineral regions of Baguio, Benguet; Aroroy, Masbate; Paracale, Ambos Camarines; and Mambulao, Ambos Camarines.
2. Mangrove swamps in the bays of Basiad, Calauag, Lopez and the western part of the Bondoc Peninsula, Tayabas.
3. The coal region of the peninsula of Sibuguey, Zamboanga.

The two last reconnaissances are still in progress.

FOREST ZONES, RESERVES AND COMMUNAL FORESTS.

The object of this section is to carry out the study and demarcation of those forest areas which ought to be retained as such and to investigate the legality of all claims within their limits, in order to determine definitely the areas which should be proclaimed forest reserves.

During the year, studies have been made in the following forest zones, which in the near future it is proposed to establish as reserves: Mounts Banahao, San Cristobal, and Arayat, and the central part of Tayabas lying between the towns of Atimonan, Mauban, Sampaloc, Tayabas, Pagbilao, and Laguimanoc. In the areas here proposed as reserves, cultivation and the destruction of the forests are proceeding at a rate that threatens the adjacent agricultural land and the public good.

Other reserves which should be considered during the coming year are the areas under license agreements and the mangrove swamps.

The conflicts and friction arising from the occupancy, whether legal or otherwise, of public land needed for forest purposes, make it necessary that the Bureau of Forestry should have control over the forest areas the exploitation of which has been granted to corporations by public auction and under license agreements. The Bureau will thus be able to retain permanently the rights of way and other land needed for conducting lumbering operations. Not only is this action necessary to prevent the litigation with which the claimants or occupants of the land often attempt to obstruct the building of railways or other logging transportation lines, but also to prevent these same occupants from destroying the stand of timber and the reproduction, objects that can at present be attained only in a limited measure and then only by maintaining a large force of guards.

Such reserves will embrace only the forest areas which have been designated in the license agreements, beside the rights of way for the extension of railways which connect the forest with the sawmill or with shipping points, in the cases where these are situated outside the area of the concession. As exploitation proceeds, the limits of the reserves may be modified, so as to exclude from them such areas as have been cleared of timber and are judged to be fitted for agricultural purposes.

The legal status of the mangrove swamps, a matter which has been in litigation since long before the end of the Spanish régime, is of such importance that it is receiving special attention on the part of the Bureau.

The reasons for proclaiming all public mangrove areas as forest reserves are based on the opinions and recommendations of the former "Inspección General de Montes" (that is, the Bureau of Forestry of the Philippines), which recommendations were supported by the "Cuerpo Nacional de Ingenieros de Montes" (that is, the Forest Service of Spain), even as they meet with the support of the Foresters of the present day, defenders, like those of the other régime, of a farsighted policy of conservation of our forest products.

Don Sebastian Vidal, considered among his colleagues as an eminent authority and better acquainted than any other with forest conditions in the Philippines, divided all the forests into six types, namely: Mangrove swamps, beach, lowland, highland, and two mountain types. Of the mangrove swamps he said in 1883:

In the mangrove zones are included all the salt swamps and marshes which are constantly washed by the waters of the sea and subject to the flow and ebb of the tides. Now this very condition, according to the laws of waters, puts these areas in the category of *public dominion* and *public use;* moreover, for the reason that in such areas there may be assured a constant tree growth, to counteract the effect of the disease-breeding vapors that emanate from them and threaten the public health, *the State is under the obligation to preserve them as forest zones.*

These recommendations and others made by various foresters induced the Governor-General of the Philippines in 1893 to order the suspension of all action on cases referring to mangrove swamps.

To-day the Bureau of Forestry holds the same opinion and will begin the establishment of such reserves in order to regulate the disposition of these areas for the benefit and protection of the sugar, alcohol and tanning industries, of fishponds and saltpans, charcoal burning, and such others as may be established for using the products of the mangrove swamps.

The object of establishing such reserves will be to regulate, by a system of leasing, the disposition and occupancy of these areas, in order to prevent the arbitrary construction of dikes, which, by interfering with the ebb and flow of the tides, would affect the development of the trees of the mangrove forests and nipa areas, or perhaps even kill them by depriving them of the very elements necessary for their growth.

This section also has charge of the establishment of communal forest, for the free use of local residents, and the accompanying table shows the present status of this work.

Communal forests are established as permanent or temporary, according to the soil conditions and the needs of the locality. If a permanent communal forest is decided on, its boundaries are made to include not only actually forested areas, but also adjacent public land which, though not covered with tree growth, is not fitted for agricultural uses, so that sooner or later it may be reforested, either by natural or artificial means. With this object in view, the Bureau of Forestry offers its coöperation to local authorities in the celebration of arbor day.

Temporary communal forests are established where the character of the terrain is such that it ought to be thrown open to agriculture as soon as the timber has been utilized; in this class of communal forests no limits are put on the amounts of timber to be taken out, nor are there any restrictions on the occupation of the land once the timber has been removed.

MAPPING AND DRAFTING.

This section is charged with all work pertaining to the indexing of sketches and the compilation of field notes, both topographical and forest valuations, taken by officers of the different forest stations.

The following table shows the work carried out during the year:

Trail notes.

District No.	Receivable.	Pending.	Total.	Forest Value.
	Kilometers.	*Kilometers.*	*Kilometers.*	*Hectares.*
1	121.48	129.75	126.18	51.80
2	70.21		70.21	9.50
3		44.86	44.86	
4	229.48	194.86	423.84	20.50
5	519.23	210.49	729.72	96.18
6	459.31	325.47	784.78	38.20
7	429.79	184.77	615.56	13.55
8	476.79	148.61	624.98	45.41
9	79.21	2.35	81.56	2.50
10	1,048.49	158.69	1,207.58	69.29
11	192.21	206.31	398.52	6.90
12		56.84	56.84	.25
13	65.14	21.60	86.74	4.02
14	130.76	68.92	199.68	5.00
Total	3,821.68	1,753.52	5,575.15	357.10

Most of the above notes have been compiled on the base maps, on which there have also been added new and valuable data from the Bureaus of Coast and Geodetic Surveys, Lands, Public Works, Constabulary, and the Division of Military Information. Eighty-four maps of communal forests have been prepared and 1367 blue-print copies of different maps have been made for the general public and for official purposes.

Communal forests established from 1908 to 1917.

Years.	Parcels.	Hectares.
1908	17	5,869
1909	21	8,279
1910	19	5,792
1911	47	13,562
1912	59	10,790
1913	25	3,362
1914	45	6,790
1915	94	13,049
1916	107	15,627
1917	84	10,035
Total	518	93,155

COMMUNAL FORESTS CANCELED.

Provinces.	Parcels.	Hectares.
Bulacan	1	232
Cagayan	1	325
Ilocos Norte	4	1,177
Misamis	1	400
Negros Occidental	2	280
Tayabas	1	126
Total	10	2,540
Total number of parcels and hectares established from 1908 to 1917	518	93,155
Total number of parcels and hectares cancelled in various years	—10	—2,540
Balance in force	508	90,615

Statement of communal forests established up to December 31, 1917.

Provinces.	Parcels established—		Total.	Mun. townships or rancherias.	
	Before 1917.	During 1917.		With C. F.	Without C. F.
Abra	19	1	20	13	6
Albay-Catanduanes	10	1	11	8	13
Ambos Camarines	24	6	30	23	15
Antique	1	2	3	2	10
Bataan	13	--------	13	11	--------
Batanes	--------	--------	--------	--------	6
Batangas	--------	--------	--------	--------	22
Bohol	9	2	11	9	26
Bulacan	--------	--------	--------	--------	24
Cagayan	27	3	30	17	6
Capiz-Romblon	25	6	31	17	14
Cavite	--------	--------	--------	--------	20
Cebu	3	5	8	6	42
Ilocos Norte	16	--------	16	14	15
Ilocos Sur	20	--------	20	17	23
Iloilo	10	--------	10	5	22
Isabela	15	--------	15	11	15
Laguna	11	--------	11	10	17
La Union	10	--------	10	10	4
Leyte	15	4	19	12	33
Mindoro	--------	--------	--------	--------	17
Misamis	12	2	14	10	42
Mindanao and Sulu—					
Agusan	1	--------	1	1	56
Bukidnon	--------	1	1	1	12
Cotabato	--------	--------	--------	--------	30
Davao	--------	--------	--------	--------	15
Lanao	1	1	2	2	36
Sulu	--------	--------	--------	--------	24
Zamboanga	3	--------	3	2	8
Mountain Province—					
Amburayan	6	--------	6	5	4
Apayao	--------	--------	--------	--------	6
Benguet	1	--------	1	1	12
Bontoc	--------	--------	--------	--------	7
Ifugao	--------	--------	--------	--------	3
Kalinga	--------	--------	--------	--------	4
Lepanto	1	--------	1	1	10
Occidental Negros	17	8	25	14	10
Oriental Negros	12	2	14	12	34
Nueva Ecija	9	7	16	15	33
Nueva Vizcaya	--------	1	1	1	7
Palawan	--------	--------	--------	--------	14
Pampanga	2	1	3	3	18
Pangasinan	29	1	30	23	42
Rizal	3	1	4	3	22
Samar	27	11	38	29	11
Sorsogon-Masbate	13	--------	13	10	14
Surigao	7	4	11	7	2
Tarlac	6	1	7	5	11
Tayabas	32	13	45	25	8
Zambales	14	--------	14	12	2
Total	424	84	508	367	901

The chief of the division and the six rangers attached to it spent in all 399 days in the field on reconnaissance work in Bukidnon and Lanao, Mindanao; in rectifying the forest zones in Mount Banahao and central part of Tayabas; in the mineral regions in Paracale and Mambulao, Ambos Camarines; Aroroy, Masbate; Sibuguey Peninsula, Zamboanga; and in the examination of forest lands in the cadastral surveys at La Paz, Tarlac; Talavera and Cabanatuan, Nueva Ecija; and Montalban, Rizal.

DIVISION OF INVESTIGATION.

This division has its headquarters within the Makiling Forest Reserve, in Los Baños, Laguna, and its work is carried on in the most intimate coöperation with that of the Forest School, this latter being, in fact conducted by the same officers as an integral part, so to speak, of the division. Whenever and wherever it is possible without detriment to the course of instruction, the work of pupils of the school in surveying, mensuration, silvical studies, and so forth, is done in such a way as to forward the investigation and working out of forest problems which the division has to solve. In this way there are obtained, on the one hand, data of great value for the division and for the Bureau in general while, on the other hand, the students are given an intensely practical training in the field along the very lines on which they will have to work when they enter the service as rangers. It will be seen than the division acquires in this way a great amount of highly valuable information about one of our greatest assets, the forests, without incurring any additional expense to the Government.

RECONNAISsANCE.

The division has not been actively engaged in any extensive pieces of reconnaisance during the year, though different members of the staff have, at vaurious times, been detailed to accompany the larger reconnaisance parties sent out by the Bureau.

The classes in forest management have continued to do small pieces of reconnaissance on Mount Makiling. The work done during the year made possible the completion of the forest map of the Mount Makiling region.

This year's summer instruction trip added the reconnaissance of a 3,000 hectare area in the Northern Laguna forest.

Reconnaissance work in small areas has been continued by rangers in District No. 5. This work does not properly belong to the Division, but it is mentioned here as having always been of special interest. It was started in 1912 by the district forester as part of his work in coöperation with the division.

DENDROLOGY.

1. *Check list of the woody plants of the Philippine Islands.*—This has been brought up to date, so far as the literature available here is concerned. It is kept on library index cards and is used pretty constantly. This year all the common names have been compiled and copied, so that they can be used in our seed studies and other work. If it is ever desired to publish the check list, it will be necessary to check all the references and to bring the statements concerning distribution up to date.

2. *The Makiling flora.*—Each of the last five years has seen considerable additions to this work. The rough draft of this report contains about 1,600 pages. As the region covered is a peculiarly rich and representative one, the number of species included thus far is about 2,000.

DENTROLOGY LECTURES.

A set of lectures has been prepared for use in the dendrology class. These lectures supplement Bulletin No. 10 and run to about 650 typewritten pages.

MINOR FOREST PRODUCTS.

For several years past, information has been collected leading to the preparation of a special report on the minor forest products. It was desired that this report should not be merely a compilation, for the Bureau already had some compilations on the subject. The most concise compilation is that in Bulletin No. 10, Part II., pp. 51–62. Besides this, there is one on minor forest products prepared in 1914–15. A portion of this was published by the Bureau of Foreign and Domestic Commerce, Department of Commerce, U. S. A., in its Special Agents Series No. 95, pp. 1–40, under the title "Rattan Supply of the Philippines."

In the following paragraphs, the effort has been made to show the present state of progress in our study of the different minor forest products.

(*a*) *Mangrove swamp work.*—Measurements have been made of the yield in planted swamps, so that it is now possible to write the section on mangrove swamps for the minor forest products publication.

(*b*) *Bamboo.*—Late in 1912 an experimental planting of about 2 hectares of Kauayan (*Bambusa spinosa*), Kauayan-kiling (*Bambusa vulgaris*), and Boló (*Gigantochloa levis*), was made on land now belonging to the College of Agriculture, between the Pili and Mulawin Rivers.

A number of studies of growth and yield of bamboo were made. These led to the preparation of a special report on bamboo which was submitted January 16, 1914.

Since that date, the progress of the planting has been covered by yearly reports. The last one was a report presented at the departmental conference on October 27, 1917.

Our original plantings are, this year, producing canes of full size; so it is apparent that planted bamboo may begin to yield a small amount of commercial material five years after planting.

We have, this year, planted an additional 2 hectares of Kauayan in our permanent plantations. In five years more this should begin to yield bamboo for repair work, fences, etc.

Studies have been made to ascertain whether the reproduction of Buho or Caña-boho (*Schizostachyum lumampao*) was as rapid as has been believed. The studies made in Bataan indicate that this species is neither so aggresive nor so rapid a grower as was supposed.

(*c*) *Rattan.*—The work on this has gone slowly, because of the difficulty attending the collection and indentification of herbarium material of rattan, and the very great difficulty experienced in getting standard classifications of trade samples.

The different Philippine rattans have been listed and their distribution recorded, so far as they are known.

(*d*) *Gutta-percha.*—In April and May of the present year, accompanied by two rangers, the chief of the division made a trip through the Bukidnon, Lanao, and Cotabato regions of Mindanao to study gutta-percha. Unfortunately, it was found that gutta-percha is not being collected at present, as a result of war conditions. Collections were made of the more valuable kinds of gutta trees. The trees were not in flower or fruit and the identifications of the sterile material have not been entirely convincing. It would seem that gutta-percha will never again be of very great importance in the Philippines, unless it can be successfully planted.

There have been included in our files lists of the known species of Sapotaceae of the Philippine Islands, keys to genera and copies of published articles on gutta-percha.

(*e*) *Rubber.*—During this year there has been worked out a classification of the baletes (wild figs) of the Mount Makiling region and we are now able to recognize the local species. Collections of latex are being made and the samples promptly analyzed by a member of the College of Agriculture. They show a low rubber content and a high percentage of resins. It has been found very difficult to collect the samples, because the latex flows very slowly and coagulates rather quickly. The experiments have not yet been continued for a sufficiently long period to determine in which season the latex flows most readily. Thus far there is no indication that any of the baletes are likely to prove profitable sources of rubber.

(*f*) *Philippine palms.*—It was the intention to include with the report on minor products a rather full account of Philippine palms, but it has not been posible to complete this work. A list of all known Philippine species, a table of the reported distribution, a list of the principal publications and a key to Philippine genera have been prepared and included in the files.

ARBORETUM.

The arboretum has received some accessions and the work of identifying and labeling has been continued as fast as possible.

WOODY VINES.

Our forests contain a large number of woody vines. Some of these are of considerable importance as sources of minor forest products, but our knowledge of them is very incomplete. In July of this year, the systematic collection of all species found in the Mountain Makiling region was begun and up to the end of the year some 35 species had been brought in. Good herbarium material and a section of the mature stem have been collected in each case.

HERBARIUM.

In connection with the dendrology instruction work there has been prepared a herbarium.

This now includes material of some 600 species of the local woody plants and is being continually enlarged. There has also been secured material of a number of the important timber species from other parts of the Islands.

SILVICULTURE.

1. *Nurseries and plantations.*—These now cover an area of over 30 hectares of permanent plantations, 1,374 hectares of special dipterocarp plantations, 0.647 hectares of rattan plantations and 32 hectares of experimental grass land planting on Mountain Makiling.

Monthly growth measurements are taken for all plants in the nursery, quarterly measurements of the trees in the plantations and yearly measurements of the planting on the mountain.

To date, about 650 species have been planted in the nursery and plantations.

It has been demonstrated that Ipil-ipil (*Leucaena glauca*), Narra (*Pterocarpus* spp.), Molave (*Vitex* spp.), Lanutan I. (*Bombycidendron vidalianum*), large-leaved mahogany (*Swietenia macrophylla*), Calantas (*Toona calantas*), Sibucao (*Caesalpinia sapran*), Teak (*Tectona grandis*), Lumbang (*Aleurites moluccana*), and Bagilumbang (*Aleurites trisperma*) are suitable for planting on a commercial scale. Besides these, Brazil Logwood (*Haematoxylon campechianum*), Banalo (*Thespesia populnea*), Palomaria de la Playa or Bitaog (*Calophyllum inophyllum*), West Indian Cedar (*Cedrela odorata*), Banuyo

(*Wallaceodendron celebicum*), and Betis (*Bassia betis*) offer a great deal of promise.

2. *Measurement of best trees.*—The measurements which are regularly recorded for the plants in the nurseries and plantations are average measurements. It has been felt that the average measurements did not show all that the planting might be made to show concerning the conditions and rates of growth. It frequently happens that a part or most of a planting receives more shade than is desirable. This will result in giving a low average rate of growth, although individual plants, which are more fortunately situated, may show a rapid rate. To give some notion of the best rates of growth secured in each planting, a special series of measurements was made in October of this year. The best tree in each lot was selected, marked with white paint and measured. The results were tabulated by hectares, a general table was prepared to give the measurements for the best tree in each lot, and, finally, a special table was prepared to show the best tree of each species in the plantations.

It is expected that these trees will be measured year after year in order to show whether the best individual are capable of growing for a number of years at a faster rate than the average. The taking of these growth records of best trees will also provide a sort of check on the regular growth measurements.

3. *Thinnings.*—The plantations at this place developed to a stage where thinning is necessary. This year, the preparation of a plan of thinning has been assigned to certain students. When the plan has been approved, laborers are sent into the area and do the thinning under the direction of the student in charge. The material taken out is cut into firewood length and piled. Careful records are kept of all details of this work, including cost.

4. *Cebu planting.*—In May, 1916, the district forester of District No. 5 with one ranger went to Cebu to inaugurate the planting project undertaken on the Talisay Estate.

The forester remained on the work until August, 1916, and the ranger till September, 1917. One thousand three hundred fifteen hectares were planted with ipil-ipil, lumbang and bagilumbang in the two years. The total cost of the project to date, exclusive of salaries of forest officers, has been ₱7,000.

The work has been remarkably well done. A report on the two year's work was given at the departmental conference, on October 6.

Another appropriation of ₱10,000 will be needed in order to finish the planting of the whole area, within the next three years.

5. *Growth studies.*—(*a*) *Of dipterocarp trees.*—The taking

of measurements begun in 1912 and in 1914 has been continued during this year. The last report on these data was presented before the Departmental Conference, September 10, 1917.

(*b*) *Of unit areas.*—During the present year there has been begun a series of studies of total wood production on areas of definite size. One-fourth hectare plots were marked and all trees on them numbered and measured. These measurements are to be taken once a year. It is expected that this will give a measure of the success of the forest.

6. *Silvical leaflets.*—The classes in silviculture in the Forest School have continued the work of preparing silvical leaflets. There are now leaflets for about 120 species, containing a considerable amount of new information.

7. *Experiments with cuttings.*—For several years, classes in Silviculture II, have had a certain amount of work to do with cuttings, as a part of their regular nursery practice. The results of this work have been carefully tabulated and have given useful information concerning a number of species. Thus far information concerning the behavior of cuttings of 143 species has been secured.

8. *Forest grown seedlings.*—Each class in silviculture has done work with seedlings which were pulled in the forest and transplanted by the bare root method. Careful records have been kept, which now show the results of the work with 45 species.

9. *Root development.*—Two years ago, there was begun a systematic study of the root development of different timber trees, particularly with reference to its effect upon nursery and plantation practice.

A feature of this work has been the preparation of mounted herbarium material, for use with classes in Silviculture.

Thus far 279 species have been studied. This work promises to be increasingly useful.

10. *Reproduction studies.*—In 1913, there were laid out five permanent reproduction plots in the cut-over area at Limay and these have been carefully examined and reported upon twice each year. Two additional plots were laid out in the same year. Last May, there were laid out seven additional plots. There are now thirteen permanent reproduction plots under observation. These are expected to show how reproduction is taking place on each year's cutting area and to show the effect of fires upon reproduction.

The last report on these plots was presented June 15, 1917. Another examination of the plots has just been made and the report will be ready by the time this goes to print.

11. *Cost records.*—It has been felt that more detailed records of cost were needed than have heretofore been kept of plantation of work.

This year, such cost records have been kept and it is expected that they will give much more complete information than has been possible heretofore.

FOREST MANAGEMENT, ENGINEERING, AND UTILIZATION.

1. *Durability tests.*—The semiannual examinations of all the durability test specimens have been made this year, as before; the last progress report on the test was made September 10, 1917. The number of pieces included in all tests up to date is 1,128, representing 234 species. It is intended to publish a progress report on durability tests during 1918.

2. *Wood preservation.*—A galvanized-iron tank has been provided for experiments in creosoting bamboos and posts by the open-tank method. The experiments will be begun as soon as the preservative can be obtained.

3. *The wood lot.*—It has now become evident that the thinnings from the plantations will furnish a considerable quantity of firewood. A plan has been prepared giving the location of the proposed wood lot. If authority can be secured to sell the firewood and use the receipts for hiring additional labor, the cutting and use of firewood from the plantations can be better systematized.

4. *Firewood studies.*—A series of studies has been carried on during the year of firewood production, cost of cutting, and loss of weight from evaporation of moisture. Also efforts have been made toward determining the average amount of firewood used in a Filipino community.

FOREST NURSERY, BAGUIO.

Nearly 20,000 cuttings have been planted to restock the nursery, besides seedlings secured from other gardens in Baguio. Of the 52 species planted, 13 came from abroad.

A portion of the nursery has been set aside to maintain seed trees.

Trial plantings of economic species have been carried on with eucalyptus, hickory, oaks, peach, pear, apple, gooseberry, raspberry, and ricinus. Most of the cinchona seedlings planted in 1916 have died.

With the coöperation of Lieutenant Governor Logan and Mayor Williams, a beginning has been made toward distributing economic species among the Igorots.

There are in the nursery about 3,500 trees of those species that have been found to succeed and about 4,000 shrubs and

1,000 vines. For reforestation experiments, about 700 camphor trees, 400 eucalyptus and 600 Mindoro pines are left.

The total available stock for all work in 1918 is about 6,000 trees, 11,000 shrubs and 2,000 vines.

Of eight species of foreign pines tried, none have succeeded very well. *Pinus longifolia* and *Pinus rigida,* which have done best, have not yet reached transplanting size, though nearly 3 years old.

Plants given out for reforestation, for coöperation with the city of Baguio and residents and visitors, amount to 26,166, valued at ₱5,062.52.

About 300 camphor trees have been put into the reforestation plots in Forbes Park No. 3, and smaller groups of several other species in Forbes Park Nos. 1 and 2.

Trinidad Farm School has planted about 500 trees.

By coöperation with the Benguet Mining Company, over 14,000 cuttings of Mirasolia (*Tithonia diversifolia* A. Gray) were planted in grasslands at the headwaters of Antamok Creek.

Some of the natural drainage channels in Forbes Park have been straightened and lined with rock to prevent erosion.

Much attention has been given to the grazing and caiñgin problems. Guards patrol the region constantly and every effort is being made to gain the coöperation of the Igorots in suppressing fires and caiñgins.

FOREST SCHOOL.

The school year 1916–17 closed on March 14 and a class of 21 graduated.

SUMMER INSTRUCTION TRIP.

The outstanding features of this year's work have been the work on the summer instruction trip and the occupancy of the new quarters.

The summer vacation trip this year occupied the period from March 18 to April 14. Leaving Los Baños on March 18, the class went by boat to Paete. The first week was taken up by the making of camp and composition studies. These studies covered about 5 hectares, and every thing above 10 centimeters in diameter was calipered. Following this, a good deal of work was done on topography and valuation.

WORK PERFORMED.

A 5 per cent survey was made of an area of about 3,000 hectares, every trees above 40 centimeters in diameter on the strips being calipered. The survey showed an average stand in excess of 20,000 board feet per acre. The most abundant trees were Tiaong, Tanguile, Mayapis, and Dalingdingan,—the first three making up more than 70 per cent of the stand, by volume. A map was prepared and presented with the report on the trip on June 25. This was the most successful summer instruction trip which the school has had.

EQUIPMENT.

During the year the new Forest School building has been occupied. It is a very great aid in the work of the school. New quarters were completed and were occupied on October 27. A commodious and convenient mess hall and kitchen have been built and a considerable amout of grading has been done on the road and grounds. Further improvements needed are: A first-class road, the installation of an electric lighting system, and the development of the grounds and additional laboratory and surveying equipment. It is hoped that it will be possible to secure these the coming year.

ADVANCED COURSE.

The course leading to a degree has not been offered this year, because of lack of personnel. Two additional men are needed. It is hoped that they can be secured and the course may be offered, beginning with the next school year.

MILITARY DRILL.

Military drill was begun in the Forest School on October 12, 1917. All Filipino students are required to drill. A number of other employees are also taking the course. Two drills are held each week and distinct improvement is being shown. Guns and other equipment should be supplied for this work.

STUDENTS.

The junior class, which began its work this school year, numbers 20, and 3 private students, 2 of them from China. The senior class numbers 21, including one private student from China.

DIVISION OF SAWMILLS AND UTILIZATION.

DUTIES.

In addition to relieving the division of forest management of the administration of the long term concession areas and sawmill licenses and administering the law providing for scaling of legs in the round, the Division is charged with the preparation of a set of grading rules suitable to Philippine timber and the training of a corps of lumber inspectors.

Coöperation with the sawmills is also sought in determining and doing away with waste both in the woods and mill and the utilization of all material possible, and in the study of the various markets, both developed and those possible of being developed.

PERSONNEL.

During the past year the most competent men of the newly graduated class of the Forest School were assigned for duty under this division and together with the rangers already on duty, who have become experienced in handling the work, the administration of the sawmill licenses has been carried on in such a manner that the complaints formerly received regarding the enforcement of the scaling law have gradually disappeared and the lumbermen feel that the Bureau is working to give them all help possible in carrying on their business in fairness to their needs and the proper handling of the forest for the future welfare of the Islands.

The personnel of the division now consists of one forester in charge, 1 field assistant, 1 lumber inspector, 1 assistant forester and 21 rangers. The rangers are called upon to handle the direct supervision of the concession areas and personally meet the mill men on administrative matters as they arise, while the forester and field assistant travel around to the various mills to supervise and check the scaling and administrative work carried on by the rangers and assist them in making mill studies.

MARKETS.

Since the establishment of the division in 1915, its activities have been constantly increasing with the improvement in conditions, the beginning of which was discussed in the report for 1916.

During 1917 the output of the chief sawmills was increased some eight million board feet and mill men report that they have never before known such an active market in the Islands.

In spite of the enforced reduction in shipments to the United States and China markets during 1917, the output of the mills was increased by the marked improvement in local markets. Building activities have increased rapidly, due both to increased activities in the other industries of the Islands and the growing tendency of the local population to build frame houses instead of the poorer class of mixed material house that has been the chief form of housing for the poorer people of the Islands.

The demand for native lumber throughout the entire year was much greater than the supply, due largely to the fact that the people now realize more fully the worth of the Philippine woods, as compared with Oregon pine and other foreign lumber.

Local lumber yards carrying stocks of mill sawn lumber were established in districts where formerly whip sawn stuff, produced as scattering demand arose, was the only source of supply.

In Mindanao, the development of the large hemp and coconut plantations and accompanying settlement of former wild lands has created a market that keeps the mills filled with orders ahead.

In the Visayan Islands and Luzon the establishment of the large sugar centrals and coconut oil refineries, together with the prosperity they have brought to the people, has produced a building activity that commands a large share of the output of the mills.

The United States Quartermaster of the Philippine division, after having thoroughly tried out Philippine timber during the last two years, during 1917 supplied practically the entire needs of the army with native instead of imported lumber, placing one large contract of 6,000,000 board feet and several smaller contracts of about 300,000 board feet.

The average monthly shipments from seven of the larger mills to local markets were about 4,000,000 board feet, making a total of 50,000,000 board feet used in 1917 as compared with 35,000,000 in 1916.

With this great increase in sale of lumber there has been a marked rise in prices, due both to the large demand for lumber and the increased cost of production through the advance in cost of materials. Prices during 1917 advanced steadily and by the end of the year had more than doubled over those of 1916, while in some cases the advance was 200 per cent, with every prospect of more increases during 1918.

FOREIGN MARKETS.

During 1917 the shortage in shipping and increasing freight rates seriously affected the shipments of lumber to foreign markets, with a consequent reduction in the amount of lumber shipped to the United States and China markets as compared to 1916.

Timber and lumber shipped to the United States during 1917 amounted to 12,488 cubic meters (5,294,912 board feet) valued at ₱483,215, as compared to 14,880 cubic meters (6,309,120 board feet) valued at ₱659,186, during 1916.

The China market has experienced an even greater decline, as shown by the figures in the following table:

	1917			1916		
	Cubic meter.	Board feet.	Value.	Cubic meter.	Board feet.	Value.
To China:						
Timber	223	94,552	₱8,730	190	80,560	₱9,484
Lumber	6,453	2,736,072	121,009	15,270	6,474,480	254,828
Total	6,676	2,830,624	129,739	15,460	6,555,040	264,312
To Hongkong:						
Timber	1,166	494,384	72,842	418	175,112	6,474
Lumber	8,310	3,523,440	215,645	9,255	3,924,120	92,949
Total	9,476	4,017,824	288,487	9,668	4,099,232	99,423
Grand total	16,152	6,848,448	418,226	25,128	10,654,272	363,735

However, mill men report increased activity in this market during December, with increasing prices and numerous inquiries from China merchants giving prospect of as active markets as the shipping facilities will permit.

In addition to the shipments above mentioned, others were made to Japan, French East Indies, and Australasia, totalling 104 cubic meters (44,076 board feet) valued at ₱5,192.

As shipments were made to Australia during 1916, the continued orders from there would indicate a good possibility of the permanent introduction of Philippine lumber into that market when transportation conditions improve.

LUMBERING OPPORTUNITIES.

With these conditions prevailing and the generally expressed confidence that the market will continue firm with the great demand for building materials following the close of the European War, the opportunity for large capital to develop the long-term license areas still open in different parts of the Islands, such as Laguna, Mindoro, Camarines, Agusan, etc., should lead to a development of the timber industry commensurate to the forest resources of the Islands.

GRADING RULES.

During the early part of 1917, the Bureau secured the services of an experienced hardwood lumber inspector familiar with Philippine lumber, who was detailed to draw up a set of grading rules suitable to the local species.

As discussed in the report for 1916, the rules adopted by the National Hardwood Lumber Association were unsuitable for Philippine lumber; therefore the trade with the United States, China, and other foreign markets, as well as numerous local deals requiring special grades of timber, made the formation of a standard set of rules imperative.

The chief advantages gained by the adoption of a standard set of rules are as follows:

1. The former custom of selling lumber log run will be done away with by the separation into the various grades,—priced accordingly,—which enables the millman to obtain the full value of the various grades of lumber, and the purchaser to obtain the grade of lumber suitable to his requirements.

2. Standard grades of firsts and seconds and export common would guarantee foreign buyers against the low grades and miscellaneous species such as have been exported at times heretofore. They would also result in a larger volume and a more satisfactory business for the buyers and sellers of export lumber.

3. Guaranteed grades will also enable the manufacturers of railroad ties, car material and construction timbers to accept the business in India and China which they could not accept heretofore on account of not being being able to guarantee the grade of their product.

A set of rules was drawn up during the year and submitted to local and foreign lumber dealers and the various lumber companies of the Islands for criticism. They have met with general approval and preparations are now under way for handling inspection under these rules, as most of the local firms have signified their desire to have inspections of their lumber made according to these rules.

In order to have a corps of inspectors to handle this work, five of the most experienced rangers of the division of sawmills and utilization were detailed to study grading work under the Bureau's lumber inspector.

Lumber mills in different parts of the Islands were visited in order that the men should become familiar with the various species manufactured in different localities. In this manner the last six months were spent, studying the different defects and qualities of lumber and learning to scale and tally it.

After becoming familiar with this work, the rangers were assigned to actual grading work, inspecting clear and merchantable grades for the Manila market and firsts and seconds for the United States market. Reinspection, with criticism and explanation, of the work done by the company inspectors was also done to show that the application of the foreign rules which were in use was impracticable.

These men are now far enough advanced to handle some inspection work and, with the instruction planned for the coming year, should develop into efficient inspectors. Positions have been offered to all of these student inspectors through the Bureau by private lumber concerns, but it was not deemed advisable to allow resignations until enough graders are available to take care of the proposed scheme of Government inspection of export lumber.

UTILIZATION.

In the administration of some of the concession areas by the division, the possibilities of doing away with various forms of waste in the forest which characterize the early stages of a new industry have been constantly brought to the attention of the loggers, so that the use of saws in felling trees and cutting logs, the doing away with the excessive sniping of logs and such forms of waste are receiving more and more attention. Furthermore, the enforcement of the law requiring scaling of logs in the round and payment for the solid contents has caused lumbermen to study the possibilities of utilizing the smaller material which formerly went into the waste pile. As a result, the large mills have installed machinery for turning out balusters, moldings, barrel staves, and box shooks from slabs and trimmings.

Three of the large mills installed automatic lathes for turning out balusters, table legs and similar material from their shorts, while a fourth has installed a sticker for the manufacture of mouldings and quarter round out of edgings which they were formerly unable to dispose of. The erection of a stave mill with horizontal band resaw, gang ripsaw and two-saw trimmer has enabled still another to utilize its slabs, which formerly went to the waste burner, in manufacturing cement barrel staves. Approximately 300,000 board feet of staves per month are manufactured, all of which go to the China market. With the installation of a barrel making plant in Manila, which is at present dependent on imported staves from the United States, the setting up of stave machines as an adjunct to sawmills should prove a profitable investment as waste material could be utilized.

Material for boxes and furniture stock also utilize the trimmings and slabs of one of the mills, the better grades of furniture stock finding a profitable market in the United States.

The production of veneer is also an assured industry in the Islands, one mill having installed both a 12-foot veneer slicer and two circular veneer saws and a dryer, for the manufacture of veneer for the United States market and cigar-box material for local trade.

THE OFFICE OF THE WOOD EXPERT.

With one exception, no radically new line of work has been taken up in this office during the year. The exception is that one of the rangers attached to the office has accompanied the party of rangers making studies in scaling and grading at mills in Occidental Negros, Bataan, and Lanao under the Lumber Inspector in charge of this work. These studies were begun in July and are expected to be finished in January, 1918. With this added experience on the part of one of its members, the office of the wood expert will be better able to form an opinion on questions that occasionally come up involving matters of wood identification, scaling and grading.

BOTANICAL SPECIMENS.

The number of botanical specimens received from the field has fallen off considerably as compared with the previous year. This is undoubtedly due, on one hand, to the fact that no special reconnaissance work has been carried on except in mangrove swamp regions, where the number of species is very limited, and, on the other hand, that there has been a great increase in homestead and other purely administrative routine work, the former especially taking field officers into a terrain where botanical collections are of little interest. There were 623 botanical specimens received during the year, of which 118 were accompanied by wood specimens. The Bureau of Science returned 400 duplicate herbarium sheets from this material, for distribution to forest stations. Beside the wood specimens with botanical material, 323 trade samples were received and identified, and about 40 numbers added to the series of foreign specimens. These last now amount to about 1,650 numbers. Ten 10-foot planks and four logs, almost all of species new to the collection, have been installed. Also, 16 planks showing the different grades of lumber as inspected by the Bureau were added to the collection.

Phenological reports to the number of 309 were received, con taining 1,839 tree names, and three lists of synonyms with 57 names.

ACCESSIONS AND WOOD SAMPLES.

Although the number of accessions of logs, planks, and smaller wood specimens has been less than in several former years, a very large amount of work has been done in working up old material, so that there are now on hand for sale or distribution hand specimens of over 275 species, of which the great majority are of well-seasoned material. The distribution of these specimens has increased proportionately, over 8,500 having gone out during the year. Of these, 996 were sold, 3,513 distributed gratis (chiefly to schools and colleges, foreign forest services and other Government entities, museums, etc.), 2,446 were furnished to the Forest School, and 1,178 to the various forest stations throughout the Islands. Of the extent and value of this form of propaganda, some idea can be obtained from the following lists of countries to which the hand specimens have gone: Australia, Canada, Cuba, England, French Indo-China, Hawaii, Hongkong, Japan, Java, Korea, New Zealand, Russia, Straits Settlements, United States (21 different States).

OTHER WORK.

Beside the preparation of hand and shelf specimens and the installation of logs and planks in the working collection, there have been made in the shop about 20 simple racks for holding commercial exhibits of articles in sacks, such as almaciga, cinnamon and other barks, etc.; the large transparencies made in Washington for the Panama-Pacific International Exposition have been mounted in the windows of the ground floor; a rack (itself consisting of authentic specimens of bamboo) has been erected to display all the manufactured articles of bamboo; the work of overhauling all the damage caused to planks by shipping to San Francisco has been almost completed; and a number of pieces of office furniture have been repaired or newly built, both for the Central Office and for forest stations. For the latter, a simple knock-down table has been designed, which can be shipped in a package of about one-fifth the bulk of the same when set up, and is at the same time easily set up at the point of destination. A large part of this work has been done with remnants of lumber, such as from heavy planks resawn for exhibit purposes or long ones cut down to the standard length of 10 feet. With the saw table installed the previous year, the utilization of such scraps is very easy and economical.

WEIGHTS OF WOODS.

A complete table of air-dry weights of all species represented in the collection of 10-foot and 6-foot planks has been prepared. The planks were carefully calipered to the nearest millimeter, at five equidistant points along both edges, for both thickness and width; these measurements were averaged, and the volumes calculated from the averages. From the resulting volumes and the weights of the planks (which were taken to the nearest tenth of a kilogram) was calculated the specific gravity air-dry.

No planks were included that had not been installed at least since the latter part of 1914. The conditions to which they are subject are peculiarly favorable to even and thorough air-drying, the planks being installed on end along the walls (but separated from the walls by an air-space) of a large and very well-ventilated hall. The planks are naturally almost all from large mature trees. It is believed, therefore, that the results, though the material and the methods were somewhat rough, will be applicable to ordinary commercial material more closely than some of the figures previously obtained from small oven-dried specimens, especially as it is known that much of the material on which such figures were based came from small trees.

It is proposed to publish this table of weights as a separate circular during 1918.

CATALOGUE.

In continuation of the work began in 1916 of classifying and rearranging the logs and planks, a similar task has been undertaken with all the minor products. For the first time, they have been completely assorted. Also, incidentally to this, there was commenced in the latter part of 1916 the compilation of an entirely new catalogue, which is intended to include everything in the collections except the logs and planks. The former are recorded under their "B. F. numbers" (Bureau of Forestry herbarium series), while the latter are recorded, as a matter of convenience, in an entirely separate register. The new catalogue has progressed to about 700 numbers, distributed as follows: Almaciga, 81 specimens; barks, tan and dye, 30; bamboos, 66; barks, medicinal, spice, etc., 20; bast fibers, 31; beeswax, 24; gutta-percha, 52; palm products (leaves, fibers, etc.), 29; rattans, 205; resins, pili and allied, 27; resins, dipterocarp, 42; resins and oils, miscellaneous, 18; rubber, 35; vines, miscellaneous, 36. There remain to be classified and recorded: miscellaneous wood specimens other than the regular "museum logs" and planks, manufactured articles of wood, tools and implements, seeds and fruits, fungi, and mineral specimens, all of which, besides such new accessions as may arrive, it is hoped to finish recording during 1918. It is intended, when this work is completed, to publish a complete catalogue of the collections, with notes on uses, distribution, abundance, etc., of the various products.

REVISION OF GROUPS OF TIMBER TREES.

During the year, there has been worked out a complete revision of the first, second, and third groups of timber, which, however, has not yet been put into effect under article 1821 of the Administrative Code. It will probably be promulgated during 1918. The list as it stands at present is given in Appendix B. There is no doubt that, as a whole, it will be proposed in its present form, but the progress of our botanical knowledge of the forest flora is so rapid that it is quite probable there may still be some minor additions and changes in nomenclature to the list as it now stands. The last regrouping was put in force about 15 years ago.

SHIPBUILDING.

As noted in the annual report for 1916, calling attention to the opportunities for lumber schooners, the undersigned is very glad to state that during the past year, shipbuilding has really gotten a foothold and is being pushed. The undersigned, as Director of this Bureau, was appointed chairman of the shipbuilding committee under the Food Commission appointed by the Governor-General and the Bureau has done much toward fomenting the building of ships throughout the Islands. At the present time, there are six establishments building schooners for auxiliary power. Several small vessels were launched during the year and a 300-ton schooner was recently launched in southern Negros. The shipyards at Bolinao, Pangasinan, have over three hundred men working in the woods, getting out ship timbers, and some 250 men working in the shipyards. All of these men are Filipinos and are being trained by Captain Hennings, who is in charge of this operation. Enough timber has been gotten out and is seasoning to build at least 10 ships from 300 tons upward, and it is expected that during this coming year these shipyards will be in a position to turn out 12 ships of over 250 tons.

The Bureau of Forestry has aided shipbuilders as much as possible in the granting of licenses and has favored licensees aiding the shipbuilding industry. Shipbuilders in Manila have made use of the Bureau in obtaining timber for their ships through licensees. As one example of such coöperation; the Bureau has sent out to forest stations and to numerous licensees in certain regions a set of blueprints showing the form and dimensions of all the crooks or knees needed for vessels of a certain type. The undersigned feels that the Bureau of Forestry has done its share toward creating at least an inter-island fleet.

So far, no very large boats have been attempted, the largest under construction being one of less than six hundred tons, but plans are under way for the building of six 3,000-ton schooners for use between the west coast of the United States and the

Philippines. It is hoped that the next annual report will give notice of the completion of these boats.

If the shipbuilding industry prospers, as it now seems to promise, this will prove a great stimulus to the lumber industry, not only directly by the increased consumption of lumber for building the ships, but also indirectly, and perhaps in even greater measure, by facilitating the exportation of lumber to foreign countries. As noted in another part of this report, the decrease in exports during the past year, especially to China, has been due entirely to the lack of shipping facilities.

The finest timber in the world can be found in the Philippine Islands for wooden ships. What was in its time the largest frigate in the Spanish Navy was built here by the Spaniards and Philippine timbers are held in very high regard not only in Spain, but along the China coast. For shipbuilding, men are available and can be trained, as has been demonstrated by Captain Hennings at Bolinao, but it is necessary that the Government take some action to facilitate the obtaining of equipment, such as engines, rigging, and hardware. These are not manufactured in the Philippines, and it is very hard for individual shipbuilders to obtain them from the United States.

ADMINISTRATIVE DIVISION.

Allusions have already been made to the work of this division and as the duties of a chief clerk are well known, only the special features of the work will be considered.

GENERAL SERVICE.

The routing of correspondence has been studied with the viewpoint of accuracy and promptness and a system instituted whereby the lack of clerks is partially overcome.

ACCOUNTING.

The changes in the accounting system inaugurated by the Bureau of Audits were adopted without confusion and with an increase of efficiency. Expense accounts are handled promptly in spite of their having to be sent through four persons before final approval.

PROPERTY

The property has been handled efficiently and such equipment as was no longer needed was transferred to other branches of the Government. Unserviceable property received from the forest stations has been repaired or condemned. Owing to the impossibility of securing certain articles from the United States, substitutes were made at a great saving by employees of the Bureau.

LIBRARY AND TRANSLATING.

New books, catalogues and trade journals are properly filed upon receipt, forestry items in local papers are clipped, and notes for the Quarterly Newsletter are gathered. Letters written in Spanish or in Philippine dialects are translated and answers prepared.

STATISTICS.

Owing to the lack of personnel, the gathering of statistics has been limited to those records needed by the accounting and property sections. During 1918, a complete record of forest statistics will be kept. In the past, these records were obtained from the Bureau of Internal Revenue.

CLASSIFICATION OF WORK.

The time spent upon different kinds of work by rangers and scalers in the division of forest management, forest lands and maps, and sawmills and utilization are shown in the accompanying table.

Nearly the same amount of time was spent upon public land classification work as before, but there was a great increase in the number of public land parcels inspected.

There has been a decrease in time spent on botanical work, chiefly because the rangers on homestead and ordinary license work have already collected most of the trees that are accessible.

FOREST CHARGES.

The trees of the Philippines are divided into four groups. Those of each group are sold at different rates.

Timber.

	Per cubic meter.
First-group trees	₱2.50
Second-group trees	1.50
Third-group trees	1.00
Fourth-group trees	.50

When ebony and camagon from which the sapwood has been stripped are presented for measurement and appraisal, there is collected on each cubic meter of ebony ₱6, and on each cubic meter of camagon ₱4.50.

Table showing number of days and cost of each class of work performed by the field force of the divisions of forest management and forest lands and maps during the fiscal year 1917.

District.	Licenses.				Public lands.				Caingins.				Communal forests.			
	Days.		Cost.		Days.		Cost.		Days.		Cost.		Days.		Cost.	
	Number.	Per-cent.	Amount.	Per-cent.	Number.	Per-cent.	Amount.	Per-cent.	Number.	Per-cent.	Amount.	Per-cent.	Number.	Per-cent.	Amount.	Per-cent.
No. 1	747	38.45	₱2,971	37.49	515	26.49	₱2,243	23.26	57	2.94	₱283	3.58	44	2.27	₱176	2.23
No. 2	865	41.42	1,329	40.55	279	31.68	1,205	36.79	18	2.04	78	2.38	34	3.84	124	3.78
No. 3	696	27.28	1,600	40.67	58	2.27	185	4.70	99	3.88	184	3.40	8	.32	27	.69
No. 4	785	29.24	2,514	29.28	1,205	44.90	4,035	47.02	61	2.27	258	3.02	109	4.06	342	3.97
No. 5	1,406	34.74	4,393	30.03	1,090	26.93	3,671	25.08	263	6.49	968	6.61	49	1.22	132	.90
No. 6	963	35.92	2,976	35.90	712	26.56	2,216	26.74	187	6.98	687	7.68	78	2.91	263	3.18
No. 7	2,190	43.58	6,157	42.20	1,322	26.30	4,101	28.10	334	6.64	1,096	7.51	89	1.77	261	1.79
No. 8	3,262	55.53	13,152	58.06	1,397	23.77	5,293	23.36	120	2.05	524	2.31	50	.85	301	1.33
No. 9	331	32.44	1,063	30.56	426	41.75	1,622	46.63	96	9.40	345	9.92				
No. 10	1,558	42.12	4,224	38.36	711	19.23	2,302	20.90	358	9.69	1,211	10.99	261	7.05	825	7.49
No. 11	2,361	57.09	6,270	55.46	452	10.92	1,507	13.33	84	2.08	295	2.60	41	.99	123	1.09
No. 12	300	24.93	802	21.87	448	36.83	1,499	40.87	88	6.90	274	7.48	10	.84	42	1.14
No. 13	142	25.95	560	25.99	124	22.66	483	22.42	27	4.94	158	7.34	6	1.10	82	1.48
No. 14	638	43.87	1,911	43.73	245	16.85	799	18.28	57	3.93	201	4.60	104	7.15	326	7.46
Total	15,744	41.71	49,922	41.65	8,979	23.79	31,161	25.99	1,844	4.90	6,462	5.39	883	2.35	2,974	2.48

Table showing number of days and cost of each class of work performed by the field force of the divisions of forest management and forest lands and maps during the fiscal year 1917—Continued.

District.	Botanical collections.				Sundays and Holidays.				Leave.				Reconnaissance.			
	Days.		Cost.		Days.		Cost.		Days.		Cost.		Days.		Cost.	
	Number.	Per-cent.	Amount.	Per-cent.	Number.	Per-cent.	Amount.	Per-cent.	Number.	Per-cent.	Amount.	Per-cent.	Number.	Per-cent.	Amount.	Per-cent.
No. 1	20	1.02	₱98	1.24	184	9.46	₱563	7.10	164	8.43	₱430	5.42	62	3.18	₱436	5.50
No. 2	9	1.02	39	1.19	111	12.56	311	9.49	57	6.47	152	4.63				
No. 3	8	.33	7	.19	162	6.35	329	8.36	50	1.97	126	3.20				
No. 4	25	.94	93	1.08	380	14.15	1,008	11.74	95	3.54	261	3.04				
No. 5	5	.13	13	.09	541	13.36	1,647	11.26	325	8.04	868	5.94	173	4.27	472	3.23
No. 6	15	.56	38	.45	354	13.29	841	10.15	139	5.18	312	3.77				
No. 7	11	.22	57	.40	656	13.07	1,457	9.98	208	4.14	447	3.07				
No. 8	49	.83	199	.88	763	12.99	2,661	11.74	234	3.98	524	2.32				
No. 9	5	.48	12	.35	118	11.55	280	8.04	36	3.61	86	2.48				
No. 10	14	.38	45	.41	468	12.66	1,076	9.78	170	4.59	379	3.45	65	1.75	360	3.27
No. 11	27	.65	89	.78	458	11.07	1,037	9.17	435	10.51	915	8.09				
No. 12	3	.25	8	.22	161	13.89	414	11.28	142	11.81	411	11.20				
No. 13	3	.55	11	.52	76	13.90	262	12.16	36	6.59	127	5.90	3	.55	9	.42
No. 14	1	.07	2	.06	202	13.89	469	10.78	59	4.05	143	3.28				
Total	195	.52	711	.60	4,634	12.24	12,355	10.30	2,150	5.69	5,131	4.32	303	.81	1,277	1.07

District.	Nurseries.				Patrol trail and trail building				Miscellaneous.				Travel.			
	Days.		Cost.		Days.		Cost.		Days.		Cost.		Days.		Cost.	
	Number.	Per-cent.	Amount.	Per-cent.	Number.	Per-cent.	Amount.	Per-cent.	Number.	Per-cent.	Amount.	Per-cent.	Number.	Per-cent.	Amount.	Per-cent.
No. 1									136	6.99	₱571	7.20	15	.77	₱155	1.95
No. 2									9	1.02	39	1.19				
No. 3	52	2.04	₱120	3.05	1,209	47.39	₱1,016	25.82	208	8.14	377	9.58	1	.04	13	.34
No. 4									12	.45	35	.40	12	.45	38	.45
No. 5									188	4.65	2,418	16.49	7	.17	55	.37
No. 6									202	7.53	824	9.95	31	1.15	181	2.18
No. 7	17	.34	86	.59					175	3.48	698	4.78	23	.46	230	1.58
No. 8																
No. 9	1	.09	2	.06									7	.68	68	1.96
No. 10	2	.05	7	.07					58	1.56	253	2.29	34	.92	330	2.99
No. 11	12	.29	42	.38	17	.41	138	1.23	187	4.52	577	5.10	63	1.52	312	2.77
No. 12									57	4.72	184	5.02	4	.33	34	.92
No. 13	6	1.10	24	1.12					124	22.66	488	22.65				
No. 14					22	1.52	28	.65	122	8.39	473	10.82	4	.28	17	.39
Total	89	.24	281	.23	1,248	3.30	1,182	.99	1,478	3.91	6,932	5.78	201	.54	1,433	1.20

SUMMARY.

District.	Total days.	Total cost.	District.	Total days.	Total cost.
No. 1	1,944	₱7,926	No. 8	5,875	₱22,654
No. 2	881	3,277	No. 9	1,020	3,479
No. 3	2,551	3,934	No. 10	3,699	11,012
No. 4	2,684	8,584	No. 11	4,137	11,304
No. 5	4,047	14,632	No. 12	1,208	3,668
No. 6	2,681	8,288	No. 13	547	2,154
No. 7	5,025	14,590	No. 14	1,454	4,369
			Total	37,748	119,871

The timber is measured in the round, but in case it has already been squared, a surcharge of 25 per cent is added to cover loss in squaring. If the timber has been manufactured, that is, sawn or roughly fashioned to approximately its finished form, it is considered as being manufactured and a charge of 100 per cent is added. This charge has been found necessary in order to discourage the invoicing of timber after manufacture, as such timber is frequently smuggled out of the forest and sold without any forest charges being paid.

Firewood.

For bacauan and tangal	Per cubic meter	₱0.20
For other woods	do	0.10

Minor forest products.

Clean salago bark	Per 100 kilos	₱6.50
Copal gum (Almaciga)	do	10.00
Gum elemi (brea de Pili)	do	16.00
Gutta-percha (guta-percha)	do	70.00
Diliman	do	10.00
Split rattan (bejuco)	do	10.00
Unsplit rattan (bejuco) 2 centimeters or less in diameter	Per 1,000 linear meters	1.50
Unsplit rattan (bejuco) more than 2 centimeters in diameter	do	3.00
Charcoal (carbon vegetal)	Per cubic meter	4.00
Dyewood (sibucao)	Per 100 kilos	1.50
Dyebark (nigue)	do	5.00
Tanbark (cascalote)	do	3.00
Wood oils (aceite de balao)	Per liter	.10
Gogo bark	Per 100 kilos	20.00

Guano, stone, and earth are secured at special rates, fixed in each case.

All products not enumerated above can be secured without license and free of charge at the present time, but during the past year information has been compiled on many other products upon which, in the opinion of the undersigned, charges should be collected and steps toward this and have already been taken in coöperation with the Bureau of Internal Revenue.

SALE OF FOREST PRODUCTS.

Although the prices of other commodities have arisen, the Government continues to sell its timber, firewood and other forest products at pre-war prices. There has been a gratifying increase in the sum received, namely:

	Timber.	Fire-wood.	Minor products.	Total.
Received in 1917	₱385,083	₱62,044	₱91,199	₱536,326
Received in 1916	378,999	47,998	72,462	494,447
Increase				₱41,879

NEW FOREST REGULATIONS.

The forest regulations issued in 1904 were completely revised to conform with the new Administrative Code and were promulgated on September 11, 1917. They differ slightly in details from the previous regulations. The chief difference is that the duties and responsibilities of licensees are more clearly defined.

The jurisdiction of the Bureau of Forestry over all public land is more clearly defined; there had been previously a tendency to regard tidal swamps and brush areas as agricultural land.

The regulations regarding caiñgins were expanded, as experience has shown that the old regulations did not cover all phases of the subject.

COOPERATION.

The Bureau has continued its former policy of coöperating fully and with every means at its disposal with all other Government Bureaus and with the Army and Navy, as well as with private entities. The many minor affairs in which, directly or indirectly, this office has occasion to coöperate with other Government entities are too numerous to give in detail. A few notable instances along these lines are: Coöperation with the Bureau of Internal Revenue and the Bureau of Agriculture in encouraging and facilitating the construction of tobacco curing sheds; increased and more intimate coöperation with the Bureau of Internal Revenue in the collection of forest charges on timber and minor products; inspection of a great part of the lumber purchased by the U. S. Army Quartermaster Corps from local lumbermen; with the Bureau of Education by putting up educative exhibits of forest products at annual fairs and garden days.

Besides the above, which might be called occasional coöperation, the routine coöperation with the Bureau of Lands in homestead, caiñgin, and other land cases and with the Bureau of Science in the collection of herbarium specimens and material for analyses, has been continued, if not in an increasing ratio, certainly in many respects in a more efficient way than before.

Great progress has been made in coöperation with lumbermen toward establishing complete and adequate grading rules for export lumber. The assistance given to shipbuilding has already been mentioned.

Analogous to the matter of grading rules are the attempts, in coöperation with local collectors and exporting firms, to standardize the methods of collecting minor products and preparing them for shipment. Circulars have been issued to forest stations and to rattan licensees giving instructions regarding the collection and preparation of commercial rattans, while, through the assistance of a large export house, small sample packages of the rattans desired and not desired for the export trade have been sent to all forest stations.

To aid the exporters of almaciga in obtaining better prices for their product, the Bureau has obtained standard samples from Singapore, the greatest minor product market in the world, of the various grade of "Manila copal," with the prices and descriptions of the methods of cleaning and sorting. Portions of these samples have already been loaned to several export firms who desired to try to assort their raw product in a similar manner.

RECOMMENDATIONS.

As already indicated in the discussion of remedies for existing evils, stricter legislation is needed.

1. A law should be passed punishing the illegal occupation of public land. This will remove one of the chief incentives for destroying forests.

This law will also oblige caiñgin makers to vacate the land or else homestead it. At present thousands of parcels of land are claimed by convicted caiñgin makers merely because the occupant is paying taxes on the land.

2. The penalty for the destruction of forests should be increased. At present, the damages collected amount to double the forest charges for the timber destroyed. A recent law in British North Borneo imposes a penalty of up to twenty times the market value of the timber destroyed, while here the penalty amounts to less than 15 per cent of the market value. The actual damages are much greater, as all small trees and seedlings are destroyed and the land, when abandoned, in most cases becomes a cogon covered waste which can only be restored to productive use at great expense.

3. The penalties for evading the payment of forest charges should be made much higher for a second offense. At present, they are only double the regular charges.

As for constructive legislation, the following recommendations are made:

1. *Reforestation.*—The Bureau of Forestry has already demonstrated its ability to carry on reforestation work. There also is no doubt about there being a scarcity of fuel and timber in certain sections of the Philippines. It therefore is recommended that legislation be secured appropriating money for carrying on systematic reforestation on a large scale. There should also be money available to furnish seed to individuals and munic-

ipalities that want to do planting. During the past year many requests for seed were refused simply because no seeds could be purchased.

2. *More forest guards are needed.*—In Java, Japan, British India and elsewhere, guards are employed to a much larger extent than in the Philippines. It will be a distinct economy to employ more guards, who can do some of the work now being performed by rangers. At least fifty additional guards should be employed to protect the forests under present conditions, thus releasing the rangers for other important technical work in line with their training.

3. It is necessary to have more clerks, not only for the Manila office, but also for the forest district headquarters. With the annual increase in the number of rangers and with the present increase in statistical work, it is essential to secure enough men to properly carry on the work. At least four more clerks are needed.

4. The illegal cutting of forest products should be classed as theft and treated as such. A law to this effect is necessary before the general public will regard illegal cutting as being something dishonorable.

5. In order to prevent the loss of revenue due to failure to invoice timber or other products, section 1520 of the Administrative Code should be changed so as to require the payment of forest charges on all forest products cut or gathered, whether removed from the forest or not, before a license will be renewed.

6. A new menace to the lumber industry has appeared. It affects only those who use lakes or sluggish streams for transporting logs. The establishment of water hyacinth (*Eichhornia crassipes*) in many parts of the Philippines, notably in Nueva Ecija, Laguna, Rizal, Camarines, and Mindanao, means that all still water will soon be impassable to rafts of logs, bancas and even steamers.

Legislation is needed providing for the destruction of this pest wherever found.

7. Section 1823 of the Administrative Code should be amended so as to include guards among those employees who are forbidden to have any pecuniary interest in forest products.

8. The digging up of rattan should be penalized by law. Every year thousands of small rattans are dug up for use as whip stocks and canes. Rattan can be had for these purposes without killing the plant and therefore this restriction will work no hardship upon any one, but will prevent the diminution of the supply of rattan.

The needs of the division of investigation and Forest School, which are most urgent are the following:

1. Additional personnel so that the advanced course in the Forest School can be offered.
2. *Material equipment.*—There is needed the installation of a lighting system for the cottages and, when possible, the installation of a small power saw for use in the experimental work of the division.
3. There is need of an arrangement by which money received from the sale of products of the plantation and from charges for products on the Makiling Reserve shall be made available for the use of the division of investigation at this place and on the reserve. This matter has been mentioned in previous reports and is increasingly important.
4. As noted under personnel, the demand in the Orient for forest officers having received training in the Philippine service is such that it is a serious problem to retain the men on their present salary. It is recommended that the salaries be placed on the same basis as in other scientific branches of the Government. Otherwise the Government will continually lose the services of trained men and be compelled to employ others who have yet to acquire the experience necessary to deal with the problems presented by local conditions.
5. The amount of per diems now received by rangers is less than the cost of living and it is recommended that they be increased from one peso to ₱1.60 per day.
6. The game law should be so amended as to make it obligatory for hunters in specified region to secure permits from forest officials and, if necessary, to entirely prohibit hunting in certain forests. The enforcement of game and fishing laws should be entrusted to forest officers as well as to other law-enforcing entities and more stringent legislation should be passed to prevent the destruction of fresh-water fish.

Arthur F. Fischer

Director of Forestry.

The Secretary of
Agriculture and Natural Resources,
Manila.

APPENDIXES.

APPENDIX A.

GRADING RULES GOVERNING THE INSPECTION AND MEASUREMENT OF PHILIPPINE LUMBER.

For grading Tanguile and the Lauans, Lumbayao, Calantas, Palosapis, Yacal, Guijo, Apitong, Pagatpat and miscellaneous hard woods, the following grades are established and described in these rules:

1. Firsts and seconds.

These two grades are combined and correspond to the highest grade of "export."

2. Export common.
3. Export shorts, chair stock, etc.
4. Sound wormy export.
5. Veneer flitches.
6. Clears.

This corresponds to the highest grade of lumber and dimension timbers as sold in local markets and as exported for other than cabinet purposes.

7. Merchantable.

This grade corresponds to lumber sold in local markets for ordinary house construction, temporary construction, etc., exported for other than cabinet purposes.

8. Culls.

This grade is to include all lumber that will not come up to the grade of Merchantable.

GENERAL INSTRUCTION.

Lumber less than 1 inch in thickness will be graded and measured the same as 1 inch. All lumber shall be graded on the poorer side of the piece.

Bright sap to the extent of one standard defect admitted on boards 10 inches and wider in the grades of firsts and seconds. On boards under 10 inches wide, bright sap admitted in proportion.

No allowances excepting on "splits" shall be made with the object of raising the grade. Splits over 2 feet long, on boards 10 feet and longer, may be marked off.

These rules define the poorest piece admissible in any grade; and each grade shall contain all lumber up to the next higher grade.

STANDARD DIMENSIONS.

Standard thickness are ½ inch, ⅝ inch, ¾ inch, 1 inch, 1¼ inches, 1½ inches, 2 inches, 2½ inches, 3 inches, and 4 inches.

Standard widths are 3 inches, 4 inches, 6 inches, 8 inches, 10 inches, and 12 inches.

Standard lengths are 6 feet, 8 feet, 10 feet, 12 feet, 14 feet, 16 feet, 18 feet, 20 feet, 22 feet, and 24 feet.

Thickness for surfaced lumber, when not otherwise specified, should be as follows:

½-inch rough surfaced two sides should be 5/16 inch.

⅝-inch rough surfaced two sides should be 7/16 inch.

¾-inch rough surfaced two sides should be 9/16 inch.

1-inch rough surfaced two sides should be 13/16 inch.

1¼-inch rough surfaced two sides should be 1 3/32 inches.

1½-inch rough surfaced two sides should be 1 11/32 inches.

2-inch rough surfaced two sides should be 1¾ inches.

For any thickness over 2 inches an allowance of ¼ inch should be made for surfacing.

Pieces more than ¼ inch less than the standard widths must be tallied down to the next standard width. These dimensions apply to all grades, excepting firsts and seconds and export common, in which all odd widths and lengths will be admitted.

Pieces with a greater variation in thickness than these rules allow shall be graded and tallied as mis-sawn.

DEFECTS.

Each of the following shall be known as a standard defect:

One sound 1½-inch knot.

Two or more smaller knots not exceeding in extent of damage one 1½-inch knot.

One straight split over 6 inches long, but not to exceed 24 inches long.

A "straight split" is defined as one that does not diverge by more than 2 inches per foot from a line parallel to the edge.

Splits over 24 inches long shall be trimmed off.

Grub holes, knot holes, pitch pockets, shake, wane, and any other defects not exceeding in extent of damage one 1½-inch knot.

One inch of bright sap on one edge or its equivalent on both edges or on one or both ends.

The extent of the damage caused by rot, dry-rot, doty heart, shake and heart cracks is difficult to define exactly and inspectors must be very careful in estimating the damage as compared with standard defects.

Sound superficial burls having the appearance of a knot are not to be considered as defects.

1. FIRSTS.

Firsts shall be 8 inches and over wide, 10 feet and over long, and shall be free of all defects, excepting pinholes not visible in the rough, and excepting that pieces containing 10 feet surface measure and over may have one standard defect or its equivalent. One quarter inch variation allowed in thickness, provided no single piece is more than ⅛ inch under standard rough thickness. This grade will admit not more than 5 per cent with this variation.

2. SECONDS.

Seconds shall be 6 inches and over wide, 8 feet and over long, admitting pinholes not visible in the rough and other defects according to surface measure as follows: Six feet, one standard defect; 9 feet, two defects; 13 feet, three defects; 18 feet and over, four defects. Variation in sawing as in firsts.

3. EXPORT COMMON.

Shall be 4 inches and over wide, 6 feet and over long. Variations in sawing as in "firsts." Pinholes visible in the rough not admitted.

Pieces 4 inches and 5 inches wide up to 10 feet long must work 66⅔ per cent clear in not over two pieces; 11 feet and over long must work 66⅔ per cent clear in not over three pieces, in both cases the full width of the piece. Boards 6 inches and over wide must work 66⅔ per cent clear. No cutting considered that contains less than one board foot.

4. EXPORT CHAIRSTOCK, SHORTS, ETC.

Shall be 2 inches and wider, one foot to six feet long. Shall be free from pinholes visible in the rough.

Pieces containing up to two board feet must be clear. Pieces containing over two board feet will admit one standard defect. Variation in sawing as in firsts.

5. SOUND WORMY EXPORT.

Shall grade strictly as first and seconds, but admitting pinholes, excepting boards having black streaks, stained pinholes, or pinholes running parallel with the face. One quarter inch variation allowed in thickness, provided no single piece is more than ⅛ inch under standard rough thickness and admitting not more than 10 per cent with this variation.

6. VENEER FLITCHES.

Flitches to be from 10 feet to 24 feet long, to be sawn as large as is consistent with good quality, and to show figure on two faces, figure showing on not less than 75 per cent of the face.

Shall be free from pinholes visible in the rough, shake, heart and rot, but will allow defects according to sizes as follows:

Pieces up to 9 by 9 inches must be clear.

Pieces larger than 9 by 9 inches up to 12 by 12 inches will admit 1½-inch of sap on one corner, or one standard defect.

Pieces larger than 12 by 12 inches will admit 2 inches of sap on one corner, or one standard defect and one straight split in one end not exceeding in length the width of the piece, or the equivalent at both ends.

Splits diverging from a line parallel to edge by more than 2 inches to the lineal foot must be cut off. White lauan flitches must be free of sap, otherwise should grade as other veneer flitches.

7. CLEARS.

Clears shall be sound lumber, well manufactured and free of rot, unsound knots, shake, splits, dry-rot or other defects impairing the strength of the piece. Pinholes not considered a defect unless so numerous as seriously to affect the strength of the piece.

Variations in sawing in "clears" will be admitted as follows:

Up to 4 inches thickness, ¼ inch allowed, provided no piece is more than ⅛ inch under standard rough thickness.

Over 6 inches in thickness, ½ inch allowed, provided that no piece is more than ¼ inch under standard rough thickness. This grade will admit not more than 10 per cent with this variation.

Slightly stained sap that will be removed when surfaced to the standard surfaced thickness of the respective dimensions shall not be considered a defect in clears.

Defects admitted as follows:

(*a*) Pieces 1 inch thick up to 7 inches wide and up to 16 feet long shall be clear; over 16 feet long will admit one standard defect, or bright sap not to exceed one-fifth the surface measure of the piece.

(*b*) Pieces 1 inch thick from 8 inches to 12 inches wide, 6 feet and 8 feet long will admit bright sap not to exceed one-fifth surface measure of the piece; pieces 10 and 12 feet long will admit one standard defect or bright sap not to exceed one-fifth surface measure of the piece; pieces 14 feet and 16 feet long will admit two standard defects, or bright sap not to exceed one-fifth the surface measure of the piece; over 16 feet long, three standard defects, or bright sap not to exceed one-fifth the surface measure of the piece.

(*c*) Pieces 1 inch thick over 12 inches wide and 6 and 8 feet long will admit one standard defect or bright sap not to exceed one-fifth the surface measure of the piece; pieces 10 and 12 feet long will admit two standard defects or bright sap not to exceed one-fifth the surface measure of the piece; pieces 14 and 16 feet long will admit three standard defects or bright sap along one or both edges equivalent in the aggregate to four standard defects if there are no other defects; over 16 feet long will admit four standard defects.

(*d*) Pieces 1½ to 2½ inches thick up to 7 inches wide and up to 16 feet long must be clear; over 16 feet long will admit one standard defect or bright sap not to exceed one-fifth surface measure of the piece.

(*e*) Pieces 1½ to 2½ inches thick, 8 to 12 inches wide up to 12 feet long will admit one standard defect or bright sap not to exceed one-fifth the surface measure of the piece; pieces 14 and 16 feet long will admit two standard defects, or bright sap not to exceed one-fifth the surface measure. of the piece; over 16 feet long, three standard defects.

(*f*) Pieces 3 to 4 inches thick up to 7 inches wide up to 12 feet long must be clear; pieces 14 and 16 feet long will admit one standard defect or bright sap not to exceed one-fifth surface measure of the piece; over 16 feet long, two standard defects or bright sap not to exceed one-fifth surface measure of the piece.

(*g*) Pieces 3 to 4 inches thick, 8 to 12 inches wide up to 12 feet long will admit one standard defect or bright sap not to exceed ⅕ of the surface measure of the piece; pieces 14 and 16 feet long will admit two standard defects or bright sap not to exceed ⅕ of the surface measure of the piece; over 16 feet long, three standard defects, or bright sap not to exceed ⅕ of the surface measure of the piece.

(*h*) Pieces 6 by 6 inches, not over 9 by 9 inches, up to 16 feet long, will admit two standard defects; over 16 feet long, three standard defects. Boxed heart not admitted.

(*i*) Pieces upward of 9 by 9 inches, up to 16 feet long will admit three standard defects; over 16 feet long, four standard defects. Boxed heart not admitted.

8. MERCHANTABLE.

Variations in sawing same as in clears. Sound stained sap not considered a defect in this grade.

Up to 4 inches in thickness, this grade will admit all sound lumber that does not contain defects seriously impairing the strength of the piece for ordinary or temporary structural purposes; will also admit wane on one edge not to exceed half the thickness of the piece nor extending over more than half the length, nor to exceed one-fourth the with of the face.

Timbers from 6 by 6 inches upward, this grade will admit: boxed heart, provided heart cracks do not extend to more than one face; also sun checks, pitch pockets, slight shakes or heart cracks, sound sap, knots, or other defects not seriously effecting the strength of the piece; and wane not to exceed one fourth the width of any face, nor extending over more than half the length of the piece.

Pieces containing more sap than heart wood shall be excluded from this grade.

APPENDIX B.

REVISED GROUPING.

FIRST GROUP. (22 woods).

Acle (*Albizzia acle* Merr.).
Aranga (*Homalium*, all species).
Bansalagin (*Mimusops elengi* L., *M. parvifolia* R. Br.).
Baticulin (*Dehaasia* spp., *Litsea euphlebia* Merr., *L. fulva* F.-Vill., *L. obtusata* F.-Vill., *L. philippinensis* Merr., *Machilus* spp., *Nothophoebe malabunga* Merr., *Phoebe sterculioides* Merr., all woods of the family Lauraceae having soft, fine-grained, golden yellow wood with more or less characteristic odor).
Batitinan (*Lagerstroemia piriformis* Koehne).
Betis (*Bassia betis* Merr.).
Calantas (*Toona calantas* Merr. & Rolfe and all other species).
Camagon (*Diospyros discolor* Willd., and other species having characteristic reddish sapwood and black or streaky heartwood).
Duyokduyok (*Mimusops calophyloides* Merr.).
Ebony (*Maba buxifolia* Pers.).
Gisok (*Shorea astylosa* Foxw., *S. balangeran* Dyer, and other species with wood of Yacal type).
Ipil (*Intsia acuminata* Merr., *I. bijuga* Ktze.).
Mancono (*Xanthostemon verdugonianus* Naves).
Molave (*Vitex celebica* Koord., *V. parviflora* Juss., *V. pubescens* Vahl, and any other species producing characteristic dense, hard wood).
Narra (*Pterocarpus*, all species).
Sasalit (*Vitex aherniana* Merr.).
Supa (*Sindora supa* Merr.).
Tambulian (*Eusideroxylon zwageri* T. & B.).
Teak (*Tectona grandis* L. f.).
Tindalo (*Pahudia rhomboidea* Prain).
Urung (*Fagraea fragrans* Roxb.).
Yacal (*Hopea basilanica* Foxw., *H. mindanaensis* Foxw., *H. ovalifolia* Boerl., *H. philippinensis* Dyer, *H. plagata* Vid., *Isoptera borneensis* Scheff., and other species with wood of the Yacal type.

SECOND GROUP (34 woods).

Acleng-parang (*Albizzia procera* Benth.).
Alintatau (*Neonauclea* sp.).
Alupag (*Euphorbia cinerea* Radlk., *E. gracilis* Radlk.).
Alupag-amo (*Litchi philippinensis* Radlk.).
Anubing (*Artocarpus cumingiana* Tréc., *A. lamellosa* Blco., *A. lanceolata* Tréc., *A. rubrovenia* Warb., *A. subrotundifolia* Elm., *A. superba* Becc., and other species with small, entire leaves, except Nangka, *Artocarpus integra* Merr.)
Banaba (*Lagerstroemia speciosa* Pers.).

Banuyo (*Wallaceodendron celebicum* Koord.).
Bolong-eta (*Diospyros pilosanthera* Blco.).
Bulala (*Nephelium mutabile* Bl.).
Calamansanay (*Neonauclea,* all species except *N. bernardoi* Merr.).
Caña-fistula (*Cassia javanica* L.).
Catmon (*Dillenia,* all species).
Dirigkalin (*Xanthostemon bracteatus* Merr.).
Guijo (*Shorea guiso* Bl.).
Kayu-galu (*Sindora inermis* Merr.).
Macaasim (*Eugenia,* all species large enough to furnish saw timber).
Malabayabas (*Tristania decorticata* Merr. and other species.)
Malacadios (*Beilschmiedia cairocan* Vid., and other species).
Malugay (*Pometia pinnata* Forst.).
Mangachapuy (*Hopea acuminata* Merr., *H. pierrei* Hance, and other species with wood of Mangachapuy type).
Manggis (*Koompassia excelsa* Taub.).
Mapilig (*Xanthostemon* sp.).
Maranggo (*Azadirachta integrifoliola* Merr.).
Narek (*Balanocarpus cagayanensis* Foxw., and *B. brachyptera* Foxw.).
Narig (*Vatica mangachapoi* Blco, and all other species).
Palomaria (*Calophyllum,* all species).
Salingkugi (*Albizzia saponaria* Bl.).
Sudiang (*Ctenolophon philippinensis* Hall. f.).
Taba (*Tristania littoralis* Merr.).
Tabau (*Lumnitzera littorea* Voigt., *L. racemosa* Willd.).
Tamayuan (*Strombosia philippinensis* Rolfe).
Tanglin (*Adenanthera intermedia* Merr.).
Tiga (*Tristania* sp.).
Tucang-calao (*Aglaia clarkii* Merr.).

THIRD GROUP. (49 woods).

Agaru (*Dysoxylum decandrum* Merr., and other spp.).
Agoho (*Casuarina equisetifolia* Forst.).
Agoho del Monte (*Casuarina,* all spp. except above).
Almaciga (*Agathis alba* Foxw.).
Amamanit (*Eucalyptus naudiniana* F. v. Muell.).
Amugis (*Koordersiodendron pinnatum* Merr.).
Anislag (*Securinega flexuosa* Muell.-Arg.).
Antipolo (*Artocarpus communis* Forst., *A. ovatifolia* Merr., *A. treculiana* Elm., and other species with large, incised leaves).
Apitong (*Dipterocarpus,* all species).
Batino (*Alstonia macrophylla* Wall., and all other species, except Dita, *A. scholaris* R. Br.).
Batukanag (*Aglaia bicolor* Merr. and other species, except Tucang-calao, *A. clarkii,* Merr.).
Bayanti (*Aglaia llanosiana* C.DC.)
Binggas (*Terminalia comintana* Merr.)
Bulog (*Aglaia everettii* Merr.).
Calumpit (*Terminalia edulis* Blco.).
Dalinsi (*Terminalia pellucida* Presl.).
Dao (*Dracontomelum dao* M. & R.).
Gisihan (*Aglaia laevigata* Merr.).
Kalingag (*Cinnamomum mercadoi* Vid.).
Kamatog (*Erythrophloeum densiflorum* Merr.).

Kansulud (*Aglaia multifoliola* Merr.).
Kato (*Amoora aherniana* Merr.).
Kayatau (*Dysoxylum turczaninowii* C.DC.).
Lanete (*Wrightia*, all species).
Lanutan 1st. (*Bombycidendron*, all species).
Lumbayao (*Tarrietia javanica* Bl.).
Lumbayao-batu (*Tarrietia* sp.).
Malabatino (*Paralstonia clusiacea* Baill., *P. platyphylla* Merr.).
Malakayan (*Shorea plagata* Foxw.).
Malasaging (*Aglaia diffusa* Merr.).
Malasantol (*Sandoricum vidalii* Merr.).
Matamata (*Aglaia elaeagnoides* Benth.).
Mayapis (*Shorea palosapis* Merr.).
Miao (*Dysoxylum euphlebium* Merr.).
Nangka (*Artocarpus integra* Merr.).
Nato (*Palaquium*, all species).
Oak (*Quercus*, all species large enough to furnish sawtimber).
Pagatpat (*Sonneratia pagatpat* Blco.).
Palosapis (*Anisoptera*, all species).
Piagao (*Xylocarpus moluccensis* M. Roem.).
Pine (*Pinus insularis* Endl. and *P. merkusii* Jungh. & de Vr.).
Red Lauan (*Shorea negrosensis* Foxw. and other species with wood of same type).
Sacat (*Terminalia nitens* Presl.).
Salamungi (*Aglaia turczaninowii* C.DC.).
Santol (*Sandoricum koetjape* Merr.).
Tabigi (*Xylocarpus granatum* Koen.).
Talisay (*Terminalia catappa* L.).
Talisay-gubat (*Terminalia oöcarpa* Merr.).
Tiaong (*Shorea teysmanniana* Dyer).
Toog (*Petersianthus quadrialatus* Merr.).
Unik (*Albizzia marginata* Merr.).
[illegible] (*Shorea polysp*[illegible]

APPENDIX C.—STATISTICAL TABLES.

TABLE NO. 1.—*Statement of the public lands application received from the Bureau of Lands and of the certifications made to the same regarding the agricultural or forest value.*

Provinces.	Received from the Bureau of Lands.							Certification made to the Bureau of Lands.							Returned to Bureau of Lands uncertified during the year 1917.				Total pending inspection December 31, 1917.			
	Pending from previous years.			During the year 1917.				Agriculture.			Forestry.											
	H.	P.	L.	H.	P.	L.	Total.	H.	P.	L.	H.	P.	L.	Total.	H.	P.	L.	Total.	H.	P.	L.	Total.
Abra	6	2	......	21	2	......	31	18	3	......	1	......	......	22	......	......	......	......	8	1	......	9
Agusan	69	9	......	178	9	4	269	144	13	......	1	......	......	166	3	1	4	8	99	4	......	103
Albay	9	4	......	30	10	......	53	13	8	......	8	......	......	29	......	......	......	......	18	6	......	24
Ambos Camarines	150	9	......	432	6	......	597	236	7	......	38	4	......	289	4	......	......	4	304	4	......	308
Antique	20	......	......	26	......	......	46	33	......	......	......	......	......	33	......	......	......	......	13	......	......	13
Bataan	42	4	1	112	6	3	168	108	4	2	2	......	......	119	2	......	1	3	42	6	1	49
Batanes	3	......	......	1	2	1	7	4	2	1	......	......	......	7	......	......	......	......	......	......	......	......
Batangas	......	......	......	......	1	......	1	......	1	......	......	......	......	1	......	......	......	......	......	......	......	......
Bohol	7	6	......	15	......	......	28	10	5	......	......	......	......	15	......	......	......	......	12	1	......	13
Bukidnon	4	......	......	18	4	......	26	20	4	......	1	......	......	26	1	......	......	1	......	......	......	......
Bulacan	14	3	1	33	3	......	54	21	3	......	1	1	1	28	1	......	......	1	24	2	......	26
Cagayan	71	10	......	230	18	......	329	202	15	......	7	......	......	238	8	6	......	14	84	7	......	91
Capiz	24	......	......	32	4	1	61	17	1	......	14	......	......	32	......	......	......	......	25	3	1	29
Cavite	......	......	......	......	2	......	2	......	1	......	......	1	......	2	......	......	......	......	......	......	......	......
Cebu	8	......	......	14	3	......	25	14	1	......	1	......	......	17	1	......	......	1	6	2	......	8
Cotabato	44	1	2	377	23	7	454	356	14	3	......	......	......	375	2	......	......	2	63	10	6	79
Davao	78	2	9	436	28	56	609	309	14	41	1	......	......	374	6	1	2	9	198	15	22	235
Ilocos Norte	13	......	......	47	7	......	67	44	5	......	2	......	......	55	4	......	......	4	10	2	......	12
Ilocos Sur	61	3	......	216	25	......	305	187	16	......	21	......	......	224	......	......	......	......	69	12	......	81
Iloilo	4	......	......	8	6	......	18	9	5	......	......	......	......	14	......	......	......	......	3	1	......	4
Isabela	89	1	......	165	5	1	261	158	4	......	1	......	......	166	1	2	......	3	94	......	1	95
Laguna	24	......	......	21	2	......	47	35	2	......	3	......	......	40	......	......	......	......	7	......	......	7
Lanao	3	1	......	92	7	2	105	69	7	2	1	......	......	81	2	......	......	2	23	1	......	24
La Union	28	2	1	119	7	2	159	60	2	2	23	......	......	87	......	......	......	......	64	7	1	72
Leyte	260	3	......	278	25	......	566	331	16	......	50	4	......	419	16	2	......	18	141	6	......	147
Mindoro	169	1	1	410	24	5	610	239	10	6	82	1	......	346	8	......	......	8	250	14	......	264
Misamis	8	......	......	46	2	......	56	45	1	......	......	......	......	46	......	......	......	......	9	1	......	10
Mountain	47	2	......	67	5	1	122	56	1	......	10	......	......	67	......	......	......	......	48	6	1	55
Negros Occidental	123	4	......	362	7	3	499	305	9	2	43	......	1	378	17	1	......	18	120	1	......	121
Negros Oriental	5	......	......	6	1	......	12	5	......	......	......	......	......	5	......	......	......	......	6	1	......	7
Nueva Ecija	683	23	11	2,204	143	25	3,089	2,074	120	28	98	6	......	2,373	44	......	3	47	21	40	5	666
Nueva Vizcaya	16	1	......	233	44	2	296	172	28	2	1	......	......	205	2	......	......	2	74	17	......	91
Palawan	369	2	1	171	4	3	550	415	5	2	20	......	......	446	3	......	1	4	102	1	1	104
Pampanga	7	1	......	26	1	1	36	20	......	1	1	2	......	24	......	......	......	......	12	......	......	12
Pangasinan	317	2	2	530	45	5	901	528	24	5	63	......	1	628	3	4	......	7	253	19	1	273

Rizal	11	1	1	41	9		68	38	7	1				54	6	2		8	8	1		9
Samar	47			45			92	70			12			88	1			1	9			9
Sorsogon	83	1		108	14		156	56	6		88			108	3			3	44	9		53
Sulu	3			12	2	1	18	15	1	1		1		18								
Surigao	4			24			28	18			8			26					2			2
Tarlac	50	3	2	231	24	12	322	244	20	18	2			279					35	7	1	43
Tayabas	207	11		786	47		1,051	434	24		190	4		654	2			2	367	30		397
Zambales	58	9	5	179	23	8	282	86	10	2	6	1		107	2			2	143	21	11	175
Zamboanga	59			479	47	8	593	414	38	4	47	2	3	510	2			2	75	7	1	88
Total	3,197	121	87	8,861	647	151	13,014	7,682	457	118	797	27	6	9,211	144	19	11	174	3,485	265	53	3,808

Fiscal year—	Homesteads.			Sale applications.			Leases.			Grand total.
	Agriculture.	Forest.	Total.	Agriculture.	Forest.	Total.	Agriculture.	Forest.	Total.	
1905	80	6	86	8		8				94
1906	318	16	334	20	1	21	1		1	356
1907	881	19	900	23		23	12		12	935
1908	2,456	51	2,507	49	1	50	26		26	2,583
1909	1,523	187	1,710	26	3	29	27		27	1,766
1910	1,175	385	1,560	34	5	39	42	2	44	1,643
1911	1,528	221	1,749	46	3	49	30	1	30	1,829
1912	2,609	301	2,910	95	11	106	47	1	48	3,064
1913	2,680	269	2,949	104	30	134	47	1	48	3,131
1913 (July 1 to December 31)	1,653	159	1,812	81	16	97	41	3	44	1,953
1914	4,812	685	5,497	279	36	315	77	1	78	5,890
1915	5,965	688	6,653	317	52	369	70	1	71	7,093
1916	6,015	670	6,685	227	18	245	55	4	59	6,989
1917	7,632	797	8,429	457	27	484	118	6	124	9,037
Total	39,327	4,454	43,781	1,766	203	1,969	598	20	613	46,363

SUMMARY.

Applications on hand during 1917		13,014
Certified for Agriculture	8,207	
Certified for Forestry	830	
Returned uncertified	174	
		9,211
Total pending December 31, 1917		3,803

TABLE No. 2.—*Statement showing amounts in cubic meters of important timbers, by species, cut and invoiced in the Philippine Islands during the fiscal years 1910 to 1917.*

Species.	Fiscal year—				July 1 to Dec. 31, 1913.
	1910	1911	1912	1913	
Lauan	43,439	46,942	57,036	81,469	20,249
Apitong	20,764	21,096	28,929	32,391	12,905
Tanguile	2,106	2,762	3,999	5,249	3,390
Guijo	14,107	14,231	18,579	17,279	7,841
Yacal	8,225	8,150	14,491	21,770	5,593
Ipil	13,717	12,296	17,237	15,791	7,535
Molave	8,923	7,978	9,091	9,363	4,783
Narra	5,744	4,996	8,474	8,877	3,941
Calantas	3,174	1,368	988	3,320	886
Palosapis					
Mangachapuy					
Dungon	2,458	1,698	1,218	981	601
Tindalo	954	1,018	794	982	484
Acle	809	867	1,295	1,690	729
Other species:					
First group	574	322	707	1,000	687
Second group	6,667	6,644	7,988	8,543	3,286
Third group	8,816	10,927	11,796	8,711	2,999
Fourth group	36,786	41,655	42,981	59,855	25,613
Total	176,758	182,945	225,548	277,171	101,502

Species.	Fiscal year—				Total, 1910 to 1917.
	1914	1915	1916	1917	
Lauan	74,453	73,277	107,634	131,699	636,198
Apitong	32,328	38,849	56,529	55,335	296,126
Tanguile	14,682	15,460	28,961	25,389	101,998
Guijo	19,701	15,650	16,685	16,857	140,930
Yacal	15,115	14,714	16,471	11,963	116,492
Ipil	17,602	12,089	14,147	16,629	127,043
Molave	9,753	10,546	10,788	13,582	84,807
Narra	8,467	9,868	7,970	5,904	64,241
Calantas	2,423	1,999	4,574	7,881	26,063
Palosapis	2,222	1,631	2,723	3,042	9,618
Mangachapuy	1,469	1,859	2,666	2,916	8,910
Dungon	2,199	1,467	1,127	1,592	13,276
Tindalo	914	1,181	1,115	1,145	8,587
Acle	1,287	1,498	1,088	798	10,061
Lumbayao				6,085	6,085
Pagatpat				1,502	1,502
Other species:					
First group	2,196	2,190	3,074	1,084	11,834
Second group	9,873	6,940	7,988	6,482	63,791
Third group	7,557	6,920	5,214	9,895	72,835
Fourth group	73,017	60,130	56,788	47,661	444,486
Total	294,758	276,268	341,442	366,891	2,243,283

TABLE NO. 3.—*Revenues derived from the sale of forest products and expenditures of the Bureau of Forestry since its organization, April 14, 1900.*

Fiscal year—	Revenue.	Expense.	Surplus.	Expense.
				Per cent.
1901 to 1906	₱2,268,591	₱1,118,887	₱1,149,704	49
1907	191,080	105,050	86,030	55
1908	211,571	107,242	104,329	51
1909	251,380	115,049	136,331	45
1910	271,582	152,161	119,421	56
1911	334,763	160,476	174,287	48
1912	354,685	200,840	153,845	57
1913	390,664	227,048	163,616	59
1913 (July to December 31)	160,913	141,131	19,782	88
1914	442,661	256,990	185,671	58
1915	425,817	274,176	151,641	64
1916	494,447	285,708	208,739	58
1917	536,328	281,126	255,202	53
Total	6,334,482	3,425,884	2,908,598	54.15

TABLE NO. 4.—*Revenue from sale of forest products, January 1 to December 31, 1917.*

Province.	Amount.	Province.	Amount.
Abra	₱1,887.23	Mindoro	₱6,679.16
Agusan	1,648.84	Misamis	4,835.89
Albay	10,066.77	Mountain	5,345.00
Ambos Camarines	22,672.85	Negros Occidental	16,473.68
Antique	500.69	Negros Oriental	8,846.73
Bataan	11,026.26	Nueva Ecija	5,406.75
Batangas	2,907.45	Nueva Vizcaya	846.71
Bohol	2,277.48	Palawan	1,978.44
Bukidnon	--------	Pampanga	1,622.61
Bulacan	8,428.01	Pangasinan	8,495.31
Cagayan	16,852.76	Rizal	3,850.60
Capiz	6,220.85	Samar	6,965.00
Cavite	524.24	Sorsogon	22,307.95
Cebu	3,669.87	Sulu	2,128.48
Cotabato	8,828.18	Surigao	8,841.78
Davao	8,483.86	Tarlac	1,880.58
Ilocos Norte	2,042.17	Tayabas	48,780.50
Ilocos Sur	2,577.25	Zambales	3,578.87
Iloilo	16,140.80	Zamboanga	36,770.63
Isabela	5,348.64		
Laguna	8,670.57	Total charges	487,665.04
La Union	562.81	Total fines and penalties	48,663.13
Lanao	4,556.58		
Leyte	16,104.19	Grand total	536,328.17
Manila	211,812.20		

TABLE No. 5.—*Timber Licenses in force during fiscal year 1917 (January 1 to December 31, 1917).*

Province.	Timber licenses.					Gratuitous licenses.				Total.
						For personal use.				
	For less than 100 cubic meters.	For 100 cubic meters and less than 1,000 cubic meters.	For 1,000 cubic meters and over.	License agreements.	Total commercial licenses.	Inside communal forests.	Outside communal forests.	For public works; second and lower group.	Miner's gratuitous licenses.	
Abra	56	34			90	5	18			23
Albay	9	16	5		30	22	7	2		31
Ambos Camarines	55	42	3	1	101	29	25	6	21	81
Antique	4	2			6		1			1
Bataan	25	24	15	1	65	1	1	3		5
Batanes										
Batangas	9	2			11		2			2
Bohol	12	6			18	8	45	10		63
Bulacan	5	54			59	2	8	3	7	20
Cagayan	26	78	3		107	82	17	8		107
Capiz	42	17			59	16	21	5		42
Cavite		1			1					
Cebu	12	4			16	5	27	2		34
Ilocos Norte	50	34			84	29		11	1	41
Ilocos Sur	9	1			10	13	12	3		28
Iloilo	15	10			25					
Isabela	7	52			59	34	7	4		45
Laguna	32	19	1		52		22			22
La Union	4	4			8	14		2		16
Leyte	63	44	4		111	29	230	5		264
Mindoro	11	56	5		72		84	3		87
Misamis	16	8	2		26	13	28	1		42
Department of Mindanao and Sulu:										
Agusan	10	3			13	4	41	2		47
Bukidnon										
Cotabato	1	4	6		11					
Davao	17	6	1		24					
Lanao	8		10	1	19	2				
Sulu		3	3		6			3		3
Zamboanga	25	10	12	2	49	2	51	6	1	60
Mountain Province	78	8	5	2	93	3	15	12	5	35
Nueva Ecija	22	15			37	17	20	1		38
Nueva Vizcaya	19	4			23		40	2		42
Occidental Negros	26	36	1	2	65	9	7			16
Oriental Negros	14	10			24	27	14	2		43
Palawan	9	14	18		41	2	30	3		35
Pampanga	3	6			9			2		2
Pangasinan	56	30			86	34	12	4		50
Rizal	22	11			33	4		1	1	6
Samar	39	24	1		64	70	34	2		106
Sorsogon	40	52	9		101	31	49	7	9	96
Surigao	30	1	3		34	9	112	3	2	126
Tarlac	12	1			13		53	1		54
Tayabas	42	72	9	1	124	10	16	6		32
Zambales	15	11	1		27	31	3	1		35
All provinces								1		1
Total	950	829	117	10	1,906	557	1,052	127	47	1,783

NOTE.—Seventy-five licenses are not included in the above figures. These licenses were either canceled or returned. In Cagayan, Isabela, and Nueva Ecija 1,563 licenses were issued for building tobacco curing houses.

TABLE NO. 6.—*Report of utilization of forest products from public forests of the Philippine Islands during the fiscal year 1917 (January 1 to December 31, 1917).*

Province.	Timber.					Firewood class.		Charcoal.	Dyewood.	Tanbark.	Dyebark.
	Group.				Total.						
	First.	Second.	Third.	Fourth.		First.	Second.				
	Cu. m.	*Cu. m.*	*Cu. m.*	*Cu. m.*	*Cu. m.*	*Cu. m.*	*Cu. m.*	*Cu. m.*	*Kilos.*	*Kilos.*	*Kilos.*
Abra	352	342	111	153	958	139	1,516				
Albay	838	740	1,175	1,185	3,938	3,720	3,645	9		18,996	
Ambos Camarines	1,317	902	6,397	3,483	12,099	14,902	44,372			123,700	9,492
Antique	20	30	43	117	210		40				
Bataan	44	2,878	28,235	12,159	43,316	2,297	17,913	271			
Batangas	49	36	1	63	149		2,385	6		135,487	36
Bohol	107	165	47	661	980	6,526	9,400			16,990	
Bulacan	211	265	383	8,772	9,631	437	1,744	617		34,409	
Cagayan	3,924	1,409	1,783	1,925	9,041	231	6,589			34,506	
Capiz	170	49	544	3,595	4,358	9,322	17,442	222			40
Cavite			4	5	9	5	2,409	16		57,045	93
Cebu	132	38	92	241	503	220	681	64		9,750	1,334
Ilocos Norte	342	298	256	432	1,328	166	258			94	
Ilocos Sur	340	287	182	151	960	58	425			199,965	
Iloilo	95	53	59	526	733	3,038	33,442	314	1,601,026	309,659	
Isabela	1,045	546	541	1,312	3,444		439				
Laguna	9	186	437	2,637	3,269	36	3,175	99		39,530	
La Union	48	50	18	15	131		12			16,621	
Leyte	1,354	555	2,398	4,800	9,107	3,500	3,129	18		4,300	60
Mindanao and Sulu:											
1. Agusan	311	48	16	1	376	191	60				
2. Bukidnon	1				1						
3. Cotabato	3,232	2,852	998	1,493	8,575	227	11,718				
4. Davao	89	27	3	103	222	1,039	480	18			
5. Lanao	230	483	9,733	29,082	39,528	13	862				
6. Sulu	2,129	537		108	2,774	1,665		9		51,882	
7. Zamboanga	4,298	5,109	8,615	19,182	37,204	2,023	1,095	78		366,384	
Mindoro	1,406	4,257	1,548	4,622	11,833	3,371	1,387			210,011	9,709
Misamis	1,074	265	222	998	2,559	80	196			2,574	
Mountain Province	319	180	44	6,668	7,211		6,764			33,336	
Negros Occidental	763	829	21,011	67,791	90,394	17,879	15,578	139		3,720	
Negros Oriental	262	210	178	509	1,159	177	1,678			465	
Nueva Ecija	545	354	46	429	1,374		891	19		45,943	
Nueva Viscaya	104	79	16	1	200		475				
Palawan	13,765	4,297		32	18,094	1,132	81			242,998	28,868
Pampanga	3	22	237	372	634	664	6,612	426		3,844	
Pangasinan	1,224	1,211	714	1,725	4,874	3,655	2,488	22		107,666	
Rizal	21	31	58	561	671	320	13,508	158		35,110	1,911

TABLE NO. 6.—*Report of utilization of forest products from public forests of the Philippine Islands during the fiscal year 1917 (January 1 to December 31, 1917)*—Continued.

Province.	Timber.					Firewood class.		Charcoal.	Dyewood.	Tanbark.	Dyebark.
	Group.				Total.						
	First.	Second.	Third.	Fourth.		First.	Second.				
	Cu. m.	*Cu. m.*	*Cu. m.*	*Cu. m.*	*Cu. m.*	*Cu. m.*	*Cu. m.*	*Cu. m.*	*Kilos.*	*Kilos.*	*Kilos.*
Samar	318	834	573	1,024	2,749	2,181	26			80,918	
Sorsogon	3,393	2,037	1,035	5,549	12,014	11,299	25,072	7		91,820	9,859
Surigao	397	143	132	412	1,084	2,167	80	11		43,187	
Tarlac	120	31	25	84	260	5	4,040	35		26,805	
Tayabas	6,324	2,411	5,085	3,875	17,695	34,989	31,825	437		250,228	19,127
Zambales	335	102	666	94	1,197	2,849	3,872	50		17,700	3,840
Total	51,105	35,178	93,661	186,947	366,891	130,472	277,224	3,040	1,601,026	3,165,687	84,864

Province.	Wood oils.	Gum mastic.	Pitch.	Gutta-percha.	Split rattan.	Unsplit rattan.		Diliman.	Stone.	Lime stone.	Gego.	Salago bark.
						Over 2 cm. diameter.	2 cm. diameter or less.					
	Liters.	*Kilos.*	*Kilos.*	*Kilos.*	*Kilos.*	*Lin. m.*	*Lin. m.*	*Kilos.*	*Kilos.*	*Kilos.*	*Kilos.*	*Kilos.*
Abra							162,223			8,883		
Albay		6,597			79,899							1,118
Ambos Camarines		153,434	1,562		861,144	336,968	796,618	784		2,000		
Antique					7,623			2,629				
Bataan					79,788	67,560	888,000	1,886			8,290	
Batangas					475						14,883	
Bohol	60				2,608		4,854	127			9	
Bulacan			473		27,465		32,980				147	
Cagayan	150	76,852			380,118	94,068	279,160	1,890				
Capiz	5,582	8,257			5,960	45	2,162	460			242	
Cavite											411	
Cebu	298				4,584						14	
Ilocos Norte					766		721			36,475	10	
Ilocos Sur					319		27,700		54,341	102,036		
Iloilo					18,440		8,000	20		1,880		
Isabela					5	34,624	77,060					
Laguna		539			40,885	40,008	8,082	8,288			864	
La Union											848	
Leyte	4,486				46,807	88,311	188,529	5,899	194		90	

Mindanao and Sulu:												
1. Agusan		54			88,983	2,280	29,025					
2. Bukidnon				508	46,658							
3. Cotabato				6,155	8,828							
4. Davao		488,664			4,065							
5. Lanao		545		18,665	590	1,000	400					
6. Sulu		6,800			1,881							
7. Zamboanga		4,984	27	5,960	81,486		5,125					
Mindoro					54,758	45,050	159,409	50,801				
Misamis	400	881			35,868		1,830					
Mountain					126,219					226,358		
Negros Occidental	2,069		48		418,656	540		9,756				
Negros Oriental	38,468				197,868	974	5,852	248			2,836	
Nueva Ecija					88,402	96,988	178,080	680			87,361	
Nueva Viscaya												
Palawan	306	40,220			10,911		1,078,194	290			85,352	
Pampanga					958		42,500	700			169	
Pangasinan		282			1,012	8,620	117,000	420			251	
Rizal					75,586	2,102	1,500				8,431	
Samar	1,171				182,828		3,600	978				
Sorsogon	665	454	181		812,590			8,600			8,642	
Surigao	480	129			95,898	6,789	18,630					
Tarlac					6,883		108,445	2,028			20,728	
Tayabas		57,769	107,095		766,575	1,948,596	7,461,765	8,356	582		1,060	
Zambales					8,101	60,000	2,801,870					
Total	54,080	795,911	109,886	26,283	4,606,310	2,824,478	18,468,264	88,790	55,067	872,082	201,155	1,118

TABLE No. 6–*b*.—*Statement of forest products, cut or gathered from re gistered private woodlands during fiscal year 1917.*

Province.	Timber.					Fire-wood.	Char-coal.	Tan-bark.	Gogo.	Dye-bark.	Rattan.			White earth balls.
	First group.	Second group.	Third group.	Fourth group.	Total.						Split.	Unsplit.	Diliman.	
	Cu. m.	*Cu. m.*	*Cu. m.*	*Cu. m.*	*Cu. m.*	*Cu. m.*	*Kilos.*	*Kilos.*	*Kilos.*	*Kilos.*	*Kilos.*	*Lin. m.*	*Kilos.*	
Albay						404								
Bataan		2	3	10	15	1,548	50						2,515	
Batangas	18	402	42	87	554	15,644		56,315		4,599				
Bulacan						10,024								
Capiz	1				1									
Cavite						8,156	560							
Cebu						83								
Ilocos Norte		21	19		40									
Iloilo						894								
Isabela	3				3									
Laguna			17	423	440	6,346	2,318	12,716			41			14,291
Mindoro	4	3			7									
Negros Occidental	102	69	315	298	784	8,270			84		120			
Nueva Ecija	178	120	11	317	626	483		933	1,493		1,203			
Palawan				1	1									
Pampanga		69	195	278	542	40,849	160							
Rizal	17	1		145	163	11,050	295	2,100						
Sorsogon				39	39									
Tarlac	3	4	18		25	15,456	40	5,500	114			94,850		
Total	326	691	625	1,598	3,240	111,652	3,423	77,564	1,691	4,599	1,364	94,850	2,515	14,291

TABLE No. 7.—*Minor product licenses in force during fiscal year 1917 (January 1 to December 31, 1917).*

Province.	Firewood.	Charcoal.	Dyewood.	Tanbarks and dyebark.	Wood oils.	Almaciga, resins, and others.	Gutta-percha.	Bejuco and diliman.	Gogo.	Others.	Total.
Abra	19			1				17		1	38
Albay	29			3				26		3	61
Ambos Camarines	77	1		7		26		172	2	2	287
Antique								17			17
Bataan	41	10				2		71	12		136
Batanes											
Batangas	7			5							12
Bohol	21										21
Bulacan	7	9				3		20	2		41
Cagayan	38			3	1	27		84		3	156
Capiz	46	2				7		20	1	5	81
Cavite	5			1							6
Cebu	8	3						1			12
Ilocos Norte	13							3		4	20
Ilocos Sur	7	1		1				1		19	29
Iloilo	92	10	21	10		1		9		9	152
Isabela	5					1		15			21
Laguna	10	1				1		30	8	1	51
La Union	2										2
Leyte	45	3				1		46		25	120
Mindoro	36	3		25				57	15		136
Misamis	5			1		2	4	14			26
Department of Mindanao and Sulu:											
Agusan	5							23			28
Bukidnon						1	1	12			14
Cotabato	10					2	3	2		3	20
Davao	10	2		1		12		2		1	28
Lanao	8			1		1	3	1			14
Sulu	2			3							5
Zamboanga	69	13		17		10	9	15		11	144
Mountain Province	15					3		22		4	44
Nueva Ecija	11	2		2		2		31	34		82
Nueva Vizcaya	5							1			6
Occidental Negros	82				2			239	25	37	385
Oriental Negros	13					11		57	4		85
Palawan	61			53	5	32		54	12	1	218
Pampanga	11	9						3			23
Pangasinan	50	2	2	10		1		3	6		74
Rizal	29	6	1	6		1			9	1	53
Samar	21			1		2		61		2	87
Sorsogon	74	6	1	12	1	3		89	3		189
Surigao	24	3		2	4	4	1	35	3		76
Tarlac	7	1		2		1		4	4		19
Tayabas	93	8	3	30		100		110	6	8	358
Zambales	39	9		3		6		29	10		96
Total	1,152	104	28	200	13	263	21	1,396	156	140	3,473

NOTE.—Ninety-eight licenses are not included in the above figures. These licenses were either canceled or returned.

TABLE NO. 8.—*Statement showing the quantity and value of wood and manufactures of wood exported from the Philippine Islands during the fiscal year 1917 (January 1 to December 31, 1917).*

		Quantity.	Value.
Timber:			
China	cubic meters	223	₱8,730
Hongkong	do	1,166	72,842
Japan	do	26	1,501
Total		1,415	83,073
Lumber:			
United States	cubic meters	12,488	483,215
China	do	6,453	121,009
Hongkong	do	8,310	215,645
Japan	do	23	1,995
Australasia	do	52	1,646
French East Indies	do	3	50
Total		27,329	823,560
Furniture:			
United States			33,441
Hawaii			2,514
Guam			488
Spain			10
China			75
British East Indies			356
Dutch East Indies			311
Hongkong			167
Japan			60
Total			37,422
All other wood:			
United States			84,545
Hawaii			13
Guam			849
Spain			1,000
China			1,044
British East Indies			496
Hongkong			3,919
Japan			708
Australasia			100
Total			92,674
Total			1,036,729

TABLE No. 9.—*Statement showing the quantity and value of wood and manufactures of wood imported into the Philippine Islands during the fiscal year 1917 (January 1 to December 31, 1917).*

		Quantity.	Value.
Ties for railways:			
United States	number	3,508	₱3,560
Timber:			
United States	cubic meters	1,293	50,140
Germany	do	1,625	10,640
China	do	125	612
British East Indies	do	832	8,157
French East Indies	do	14	1,266
Australasia	do	6	335
Total		3,895	71,150
Lumber:			
United States		6,506	183,318
Germany		13	162
Japan		10	1,133
China		91	5,571
British East Indies		171	4,683
French East Indies		7	107
Hongkong			11
Total		6,798	194,985
Furniture:			
United States			47,804
Austria Hungary			24
Germany			1,456
Spain			20
China			11,511
Japan			13,446
British East Indies			310
French East Indies			63
Hongkong			444
France			69
Korea			41
Entered for warehouse			253
Total			75,441
All other:			
United States			537,342
United Kingdom			2,203
France			1,733
Germany			4,475
Italy			1,123
Netherlands			8
Spain			3,226
Switzerland			29
China			95,135
British East Indies			4,471
Dutch East Indies			170
French East Indies			233
Hongkong			330
Japan			109,059
Australasia			9
Entered for warehouse			1,622
Total			761,168
Total			1,102,745

TABLE No. 10.—*Statement showing the quantity and value of the gums and resins exported from the Philippine Islands during the fiscal year 1917 (January 1 to December 31, 1917).*

	Kilos.	Value.
Copal (almaciga):		
United States	471,284	₱168,970
British East Indies	103,908	12,550
French East Indies	602	100
Japan	16,721	7,150
Australasia	1,050	170
Total	593,560	188,940
Elemi (pili resin):		
United States	78,468	29,392
Japan	380	133
Total	78,848	29,525
Gutta-percha:		
United States	5,653	4,613
British East Indies	8,706	7,027
Total	14,359	11,640
Rubber:		
United States	29,279	80,133
Hongkong	550	64
Total	29,829	80,197
Total	716,596	310,302

TABLE NO. 11.—*Statement af appropriations and expenditures Bureau of Forestry (January 1 to December 31, 1917).*

Appropriation:		
Act No. 2672	₱294,340.00	
Emergency board resolution No. 82	5,000.00	
Total		₱299,340.00
Expenditures:		
Salaries and wages	206,813.31	
Furniture and equipment	4,965.26	
Traveling expenses of personnel	36,874.34	
Rentals of buildings and grounds	2,324.44	
Freight, express, and delivery service	1,348.98	
Printing and binding reports, documents, and publications	1,500.00	
Postal, telegraph, and cable service	3,600.00	
Illumination and power service	1,352.24	
Plant and equipment repair service	1,111.64	
Contingent service	1,274.20	
Consumption of supplies and materials	16,298.72	
Total expenditures		277,463.13
Balance		21,876.87
Appropriation for Cebu reforestation (Act No. 2649):		
Balance January 1, 1917		6,576.91
Expenditures:		
Salaries and wages	1,401.06	
Traveling expenses of personnel	406.90	
Freight, express, and delivery service	103.26	
Postal, telegraph, and cable service	22.10	
Consumption of supplies and materials	1,495.43	
Rentals of buildings and grounds	72.50	
Plant and equipment repair service	.60	
Furniture and equipment	160.65	
Total expenditures		3,662.50
Balance		2,914.41
Appropriation for Forest School building (Act No. 2583):		
Balance, January 1, 1917		6,069.65
Expenditures		6,026.97
Balance reverted to Insular Treasury as per journal voucher No. 149618		42.68
Appropriation for Agusan reconnaissance (Act No. 2521):		
Balance, January 1, 1917		284.85
Expenditures		284.85
Statement of Bureau of Forestry appropriations, expenditures, and revenues for fiscal year 1917:		
Appropriations		305,916.91
Revenue		536,328.17
Expenditures		281,125.68
Surplus		255,202.54
Percentage of expenditures to revenue		.53

DIRECTORY OF THE BUREAU OF FORESTRY.

ARTHUR F. FISCHER, *Director.*

DIVISION OF FOREST MANAGEMENT.

Theo. C. Zschokke	Chief, Forester.
F. L. Pray	Forester.
Ramon J. Alvarez	Assistant Forester and Inspector.
Ciriaco Lopez	Ranger, Revisor of field work.
Luis Agudo	Junior Stenographer.
E. E. Schneider	Wood expert.
Luis J. Reyes	Ranger.
Justo M. Pascual	Ranger.
Valentin Franco	Clerk.
Aurelio Maglunog	Clerk.
Hermogenes Castañeda	Varnisher.
Mariano Sangalang	Carpenter.
Juan Abadilla	Laborer.

LICENSE SECTION.

Eufemio Santillán	Chief.
Lorenzo Pakingan	Clerk.
Policarpo Santos	Clerk.
Florentino Tenorio	Clerk.

DISTRICT NO. 1.

[Provinces: Cagayan, Isabela, Nueva Vizcaya and Amburayan.]

Forest station at Aparri, Cagayan (district headquarters):

Nazario Peñas	Head ranger, in charge.
Benigno Alejandro	Ranger.
Deogracias Guzman	Ranger.
Benito Agdamag	Forest guard.

Forest station at Tuguegarao, Cagayan:

Temporarily closed.

Forest station at Ilagan, Isabela:

Cayetano Barros	Ranger, in charge.
Ventura C. Achanzar	Forest guard.

Forest station at Echague, Isabela:

Vicente Velasco	Ranger, in charge.
Eugenio de la Cruz	Forest guard.

DISTRICT NO. 2.

[Provinces: Ilocos Norte, Ilocos Sur, Amburayan (Mt.), Abra and La Union.]

Forest station at Vigan, Ilocos Sur (district headquarters):

Espiritu Paraiso	Head ranger, in charge.
Pastor de la Peña	Ranger.

DISTRICT NO. 3.

[Province: Mountain Province (Benguet, Bontoc, and Lepanto).]

Forest station at Baguio, Benguet (district headquarters):

Eladio C. Leaño	Ranger, in charge.
Gregorio Labitag	Ranger.
Sixto Laraya	Ranger.
Pedro Gacad	Forest guard.
Esperidion Gapuz	Forest guard.
Silverio Gapuz	Forest guard.
Benito Rillorta	Forest guard.
Nicolas Macusi	Forest guard.

DISTRICT NO. 4.

[Provinces: Pangasinan, Nueva Ecija, Tarlac and Northern Zambales.]

Forest station at Dagupan, Pangasinan (district headquarters):

Felipe Danao	Head ranger, in charge.
Felix Bawan	Ranger.
Juliano Daclison	Ranger.

Forest station at Cuyapo, Nueva Ecija:

Probo Villanueva	Ranger, in charge.

Forest station at Cabanatuan, Nueva Ecija:

Vitaliano Villavicencio	Ranger, in charge.
Mauro Baculi	Ranger.

DISTRIST NO. 5.

[Provinces: Batangas, Laguna and Tayabas.]

Forest station at Los Baños, Laguna (district headquarters):

Roscoe B. Weaver	Forester, District Forester.
Ismael Pascual	Ranger.
Fernando L. Amarillas	Ranger.
Adriano Santos	Ranger.
Crispino Tansioco	Ranger.
Eulogio Duldulao	Ranger.
Severo Abellera	Clerk.
Alipio Larracas	Forest guard.
Felix Columbres	Forest guard.
Antonio Yafana	Forest guard.

Forest station at Infanta, Tayabas:

Catalino Cailipan	Ranger, in charge.

Forest station at Laguimanoc, Tayabas:

Alejandro de Mesa	Ranger, in charge.
Fortunato Manuel	Ranger.
Bernabe Guieb	Ranger.
Benito Acedillo	Forest guard.
Francisco Vargas	Forest guard.

Forest Station at Lucban, Tayabas:

Enrique Resultan	Ranger, in charge.

Forest station at Calauag, Tayabas:

Macario A. Mariano	Ranger, in charge.
Pedro Afalla	Ranger, Scaler.
Atanasio Catambay	Ranger, Scaler.

DISTRICT NO. 6.

[Provinces: Albay, Ambos Camarines and Sorsogon excluding Masbate.]

Forest station at Naga, Ambos Camarines (district headquarters):

Porfirio San Buenaventura	Ranger, in charge.
Mauro Ablaza	Ranger.
Manuel Montalvo	Ranger.
Catalino Clemente	Clerk.

Forest station at Legaspi, Albay:

Felipe Fajatin	Ranger, in charge.
Eugenio Espiritu	Forest guard.

Forest station at Paracale, Ambos Camarines:

Fausto Alambra	Ranger, in charge.
Tomas Manzano	Ranger.
Pedro Magistrado	Forest guard.

Forest station at Sorsogon, Sorsogon:

Filemon Kapuno	Ranger, in charge.
Alejandro Eguarras	Forest guard.

DISTRICT NO. 7.

[Provinces: Antique, Capiz, Iloilo, Negros Occidental, and Romblon.]

Forest station at Iloilo, Iloilo (district headquarters):

Juan Lopez	Ranger, in charge.
Mamerto Azurin	Ranger.
Leonardo Laguio	Ranger.
Vicente Villaflor	Ranger.
José Reliz	Junior stenographer.

Forest station at Cadiz, Negros Occidental:

Tomas N. Roque	Ranger, Scaler, in charge.
Melecio Lopez	Ranger.
Pedro Hinolan	Ranger.
Nicanor Legaspi	Ranger, Scaler.
Teodoro Oliveros	Forest guard.
Januario Buensuceso	Forest guard.
Hermogenes Doblon	Forest guard.

Forest station at Fabrica, Negros Occidental:

Felipe Amos	Ranger, Scaler.
Juan Verzosa	Ranger, Scaler.
Ruperto Yzarri	Forest guard.

Forest station at Ilog, Negros Occidental:

Ramon Larracas	Ranger, in charge.
Deogracias Mendoza	Ranger.
Inocencio Debuyan	Forest guard.

Forest station at Calivo, Capiz:

Isabelo Achacoso	Ranger, Scaler, in charge.

Forest station at San Carlos, Negros Occidental:

Jesus O. Duran	Ranger, in charge.

DISTRICT NO. 8.

[Provinces: Zamboanga, Cotabato, Davao, Sulu, Misamis, Lanao, and Bukidnon.]

Forest station at Zamboanga, Zamboanga (district headquarters):

James Logan	Forester, District Forester.
Charles Kollman	Field assistant.

Forest station at Zamboanga, Zamboanga (district headquarters)—Cont.

Benito L. Roque	Ranger.
Leon Belen	Ranger, Scaler.
Teodoro Tecson	Ranger, Scaler.
Bernardo Serafica	Clerk.

Forest station at Cotabato, Cotabato:

Severo Oliveros	Ranger, Scaler, in charge.
Sixto Babao	Ranger, Scaler.

Forest station at Davao, Davao:

Simplicio Aguilar	Head ranger, in charge.
Vicente Ceballos	Ranger.

Forest station at Isabela, Basilan:

Leon C. Franco	Ranger, Scaler, in charge.
Teodoro Colcol	Ranger, Scaler.

Forest station at Kolambugan, Lanao:

Bernardo Tocmo	Ranger, Scaler, in charge.
Enrique Alviar	Ranger, Scaler.
Gregorio Miras	Ranger, Scaler.
Manuel Malana	Ranger, Scaler.

Forest station at Naga-Naga, Zamboanga:

Santiago Babaran	Ranger, Scaler, in charge.
Macario Simeon	Ranger, Scaler.
Nicanor Santos	Ranger.

Forest station at Port Banga, Zamboanga:

Antonio Somonte	Ranger, Scaler.
Jose Phasis C.	Ranger, Scaler.

DISTRICT NO. 9.

[Province: Palawan.]

Forest station at Puerto Princesa, Palawan (district headquarters):

Apolinario Suyat	Ranger, in charge.
Max. E. Fernandez	Ranger.

Forest station at Coron, Palawan:

Ptolomeo Causing	Ranger, in charge.

DISTRICT NO. 10.

[Provinces. Leyte, Surigao, Samar and Masbate (Sorsogon).]

Forest station at Tacloban, Leyte (district headquarters):

Felix Franco	Ranger, in charge.
Carlos Guerrero	Ranger.
Eusebio Leuterio	Ranger.
Perfecto Tomeldan	Ranger.
Inocencio Ramirez	Ranger.
Alfonso Salazar	Forest guard.

Forest station at Catbalogan, Samar:

Pedro Lasquety	Ranger, in charge.
Ramon Acuña	Ranger.

Forest station at Masbate, Sorsogon:

Numeriano Valencia	Ranger, in charge.

Forest station at Surigao, Surigao:

Angel Mallonga	Ranger, Acting, in charge.

DISTRICT NO. 11.

[Provinces: Bataan, Pampanga, Bulacan, and part of Zambales.]

Forest station at Orani, Bataan (district headquarters):	
Agapito L. Cenabre	Ranger, in charge.
Julio Baldemor	Ranger.
Braulio Cristobal	Ranger.
Hilario Borromeo	Forest guard.
Forest station at Limay, Bataan:	
Donato P. Miranda	Ranger, Scaler, in charge.
Lorenzo de Guzman	Ranger, Scaler.
Valentin Sajor	Ranger, Scaler.
Forest station at Moron, Bataan:	
Pablo Tuñgol	Ranger, in charge.
Teodoro Mgalindan	Forest guad.
Forest station at Norzagaray, Bulacan:	
Pedro Gañgan	Ranger, in charge.
Exequiel Angeles	Forest guard.

DISTRICT NO. 12.

[Province: Mindoro.]

Forest station at Calapan, Mindoro (district headquarters):	
Cecilio Maneja	Ranger, in charge.
Cornelio Nable José	Head ranger.
Emeterio Edmilao	Ranger.
Antonio Martinez	Ranger.
Forest station at San José, Mindoro:	
José Medina	Ranger, in charge.

DISTRICT NO. 13.

[Provinces: Cavite and Rizal.]

Forest station at Manila (district headquarters):	
Domingo L. Diaz	Head ranger, in charge.
Clemente Mariano	Head ranger.

DISTRICT NO. 14.

[Provinces: Cebu, Bohol, Negros Oriental, and Agusan.]

Forest station at Cebu, Cebu (district headquarters):	
José B. Hirro	Ranger, in charge.
Vicente Defensor	Ranger.
Antonio Rodrigues	Forest guard.
Forest station at Dumaguete, Negros Oriental:	
José Lazaro	Ranger, in charge temporarily.
Cruz V. Muñasque	Ranger.
Forest station Talisay, Cebu (reforestation project):	
Placido Dacanay	Ranger, in charge.
Francisco L. Rola	Ranger.
Forest station at Butuan, Agusan:	
Aquilino Contreras	Ranger, in charge.

DIVISION OF FOREST LANDS AND MAPS.

Rafael Medina	Chief.
Vicente Malana	Clerk.

LANDS SECTION.

Doroteo Soriano	Ranger, in charge.
Andres Bernardo	Head ranger.
Luis Serrano	Ranger.
Edilberto Madrid	Ranger.
Vicente Castillo	Ranger.
Felipe Valderrama	Ranger.
Severo Ponce	Ranger.
Fausto Turla	Clerk.
Pedro Gorospe	Clerk.
Pedro Agbayani	Clerk.

MAPPING AND DRAFTING SECTION.

Cornelio Samaniego	In charge.
Cayetano Crisostomo	Draftsman.
Gregorio Vicencio	Draftsman.
Hermogenes Reyes	Draftsman.
Meliton Alaoria	Draftsman.
Eliseo Romualdo	Draftsman.

DIVISION OF INVESTIGATION (LOS BAÑOS).

Dr. Fred. W. Foxworthy	Chief.
James R. Gillis	Instructor in Forestry.
Mauricio J. Oteyza	Forester, (temporarily assigned to Baguio).
Maximo Oro	Ranger.
José F. Nano	Ranger.
Carlos Sulit	Ranger.
Calixto Mabesa	Ranger.
Nemesio Catalan	Ranger.
Pastor Martelino	Ranger.
Placido Dacanay	Ranger, (special assignment to District 14).
Francisco L. Rola	Ranger, (special assignment to District 14).
Segundo Peñaflor	Nurseryman.
Florentino Canicosa	Forest guard.
Nicolas Angeles	Forest guard.
Fernando Aquino	Forest guard.
Domingo Ilag	Forest guard.
Rufino Manzano	Forest guard.
Severo Parado	Forest guard.
Pedro Ortega	Forest guard.
Vicente Supleo	Junior stenographer.
Jovite Unite	Junior stenographer.

DIVISION OF SAWMILLS AND UTILIZATION.*

William Crosby	Chief, Forester.
M. W. Rice	Lumber inspector.
Florencio Tamesis	Assistant forester.

ADMINISTRATIVE DIVISION.

Cirilo Asperilla	Chief Clerk (Acting).
Vicente C. Ramos	Stenographer and disbursing officer.
Pedro Asuncion	Junior stenographer.
Jose Alegre	Clerk.
Pelagia Fernandez	Telephone operator.
Valentin Cordero	Messenger.

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* All scalers under Division of Forest Management also under this division.

RECORD SECTION.

Isidoro Sebastian	Chief.
Juan Ipac	Clerk.
Aquilino C. Bartolome	Messenger.
Mauro Linchanco	Messenger.

ACCOUNTING SECTION.

Eugenio Tadle	Chief.
Simeon Mangaliman	Clerk.
Angel del Rosario	Clerk.
Sulpicio Olimpo	Clerk.
Primitivo Bello	Clerk.

PROPERTY SECTION.

Simplicio Beltran	Chief.
Ramon Jingco	Clerk.
Venancio Babida	Clerk.
Severino Esguerra	Watchman.
Epitacio Oblepias	Watchman.
Crisanto Navarro	Laborer.
Bartolome Estacio	Janitor.
Feliciano Guiling	Janitor.
Mariano Aldama	Chauffeur.

○

ERRATA

Page 5, line 26, should read "forest officers" instead of "foresters".

Under line 2, of License Statistics "1918" should read "1917".

On page 13, line 14, "licensed" should read "license".

Page 35, line 8, under "Utilization," "everage" should read "average".

Page 56, in second line from bottom, "16.2 square kilometers" should read "162 square kilometers". Likewise, on page 57, line 1, "25.2 square kilometers" should read "252 square kilometers" and in line 3, "4.2 square kilometers" should read "42 square kilometers".

The first two words of line 4, page 59, should read "Bureau's charge" instead of "Bureaus charged".

Table 1, of the Appendix is changed as per inserted sheet.

Page 71, column "1906, Homesteads, Total" should read "334" instead of "344".

Table 8, page 82, third sum from bottom of Value column should read "30,346" instead of "62,501".

Table 9, page 83, fourth line from the bottom ₱650,691.66 should read ₱650,691.62 and second line from bottom should read therefore ₱316,437.74.

Division of Investigation and Forest School, Los Baños, Laguna.

Forest School Graduates in the Philippine Guard. The man to the right of the Director received his training in the United States.

PLATE I.

THE GOVERNMENT OF THE PHILIPPINE ISLANDS
DEPARTMENT OF AGRICULTURE AND NATURAL RESOURCES
BUREAU OF FORESTRY

Annual Report of the Director of Forestry of the Philippine Islands

For the Fiscal Year Ended December 31, 1918

ARTHUR F. FISCHER
Director of Forestry

MANILA
BUREAU OF PRINTING
1919

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ANNUAL REPORT OF THE DIRECTOR OF FORESTRY.

MANILA, *March 3, 1919.*

SIR: I have the honor to submit herewith the Annual Report of the Bureau of Forestry for the fiscal year 1918, covering the period from January 1 to December 31, 1918.

WAR ACTIVITIES.

Very close coöperation was maintained by the Bureau of Forestry with the army officials of the Department of the Philippines in supplying information as to products for war work. Administration of all military reservations, in so far as forest activity was concerned, was placed in the hands of the Bureau of Forestry and information was given as to the stands and availability of woods for various purposes for the Army. The same coöperation was maintained with the Navy in respect to naval reservations. During the past year the Bureau of Forestry instituted an organization to supply the Navy with rattan for war work and helped the Department in its reconnaissance of naval reservations containing timbers to determine sources of future supply of woods and other products. Information was supplied to the various naval authorities at Hongkong, the British army authorities in India, and the French naval authorities in Saigon. Help was given lumbermen furnishing supplies for war work. The various offices of the Philippine Department, U. S. Army, were able to use the personnel of the Bureau, as well as past information along various lines. Help was also accorded the Council of National Defense. All this coöperation and help would have been impossible had it not been for the work done in past years.

In June, one assistant forester, one forest supervisor, seventeen rangers and two students from the Forest School entered the officers' training camp of the Philippine Guard preparatory to federalization. It is gratifying to note that out of the 21 foresters entering the Philippine Guard, twenty of whom were Forest School graduates, only one resigned and the rest were all proficient enough to obtain commissions. The assistant forester received his training in the United States. The withdrawal of this number, although small, made great inroads on the technically trained personnel of the Bureau of Forestry, necessitating a complete shift in personnel. Many projects had to be partially abandoned, and some new ones could not be inaugurated. Practically 80 per cent of the technical personnel of the Bureau of Forestry signified their intention of entering the war if possible, through the Philippine Guard, but the Government only allowed the release of the number stated above. The wood expert, on account of his knowledge of European languages, has been detailed since August 1 to work afternoons in the chief mail-censor's office for the duration of the war.

During the year, Red Cross subscriptions within the Bureau amounted to ₱688.50. Through the courtesy of the Governor-General, the Director was given permission to solicit subscriptions amongst the lumbermen and Bureau personnel for the Forestry Regiment Fund and the total collection amounting to ₱1,706.50 was forwarded to Washington. The results of the various Liberty Loan drives during the past year have been particularly gratifying to the undersigned, because of the large number of subscriptions by Filipino employees.

LEGISLATION.

During the past year no new bills were introduced by the Legislature directly or indirectly touching upon forestry matters.

The bill to which attention was called in last year's annual report, containing provisions for the protection of fruit trees found in the forest, has again been introduced.

The Bureau of Forestry proposed quite a few changes in the wording of the sections of Chapter 47, known as the Forest Law, of Act 2711 (the Administrative Code) under which the Bureau of Forestry operates. These changes are very necessary to remove ambiguities and to make clear certain phrases in the present sections of the forest law.

Suggested changes were sent to the Bureau of Internal Revenue to be submitted by them for the sections of the Bureau of Internal Revenue Law having to do with forest products.

Suggested bills were submitted for a special reforestation act, as well as for reconnaissance, and attention was called to the lack of adequate administration of fisheries and game. Under the Administrative Code, the Bureau of Forestry is empowered to grant fish-pond permits, but no adequate means is available for the administration of general fisheries or for enforcing the present game laws of the Islands. The Bureau of Forestry has found it very difficult, during the past year, to apprehend people setting fire to kogon areas. As these fires are generally set by hunters, if the administration of the game laws were turned over to the Bureau of Forestry, the number of fires would be greatly decreased, and game would be afforded better protection in the Philippines.

PERSONNEL.

The question of personnel has become increasingly important in the Bureau. The appropriation for salaries in this Bureau has not been sufficient to even pay the men, especially the field personnel, the salaries which prevail in other bureaus of the Government, for work requiring an equal degree of technical knowledge and experience. A comparison of the salaries paid with what the men could receive in private enterprise, coupled with the increased cost of living, has made it most difficult to hold the personnel. As the average ranger's expense for board and room throughout the Islands amounts approximately to ₱25 or ₱30 a month, and his salary to ₱75, it can be seen that not much money is left for clothing and other necessities. Probably no other Government employees are subject to such physical and mental discomforts in carrying on their work. As most of it is conducted in the more isolated and forested regions of the Philippines, generally distant from habitations and from centers of civilization, they have to forego many of the advantages accruing to other Government employees. Transportation in many parts of the Philippine Islands is exceedingly difficult. In the past year rangers who were ordered to make inspections were forced to take small bancas for long trips and have been blown way out of their course into the open sea, experiencing dangers which would have deterred other men from similar modes of travel in the future.

The cost of supplying themselves with clothing, especially footwear, during their arduous field trips in the tropical forest usually amounts to twice and sometimes as high as four times the cost to other Government employees. In many instances no trails whatever are available. Travel through the jungle is not pleasant and practically all of it is on foot. A pair of good shoes for field work generally lasts about one month and many rangers have worn out, on occasions, as many as three pairs of shoes per month. As a result, with the present high prices of footwear, the rangers have been using alpargatas, which last a very short time and do not afford sufficient protection for the feet. Sickness has been prevalent among the field force, and in many instances rangers have been taken sick among the hill tribes where no medical attention was available. After field trips fully 70 per cent of the men took sick leave because of fevers and other ailments. These facts must be recognized, and it is obvious that the Government should take cognizance of them and place the Bureau of Forestry personnel at least on an equal plane with other bureaus in regard to salaries of men of equal technical training.

During the past year rangers and clerical personnel have constantly requested transfers or presented their resignations, which were generally refused, because of lack of men to carry on the administrative and other work of this Bureau. Requests have come from foreign governments for trained rangers as well as clerks of this Bureau at much higher salaries than they receive here, and this has tended to create a restive condition, as few resignations were allowed, although the undersigned personally does not feel that he should be the means of holding the men down to positions where the financial reward is not sufficient to provide an adequate living. It has only been through a highly developed *esprit de corps* that this Bureau has been able to hold the majority of its men; but with the constant pressure necessary under present conditions, with an inadequate personnel, offering no inducements other than hard work, as compared with what other bureaus can offer in the way of promotion and much more congenial work, the undersigned feels that the Government should take a timely interest in keeping up a technical organization such as this Bureau has. Rangers who were trained in lumber grading and scaling were particularly in demand by the lumber companies, not only in the Philippines, but in the Federated Malay States as well. One ranger whose resignation was not accepted, simply quit the service, forfeiting his accrued leave, as he was offered a salary and opportunities which under the circumstances he felt could not be refused.

The following changes in personnel have occurred during the past year. Two of the rangers who were instructors in the Forest School resigned, one to enter West Point and the other to take up advanced work in the College of Agriculture. The latter is now receiving as much money as student assistant at the College of Agriculture as he had been getting in this Bureau. One ranger died, two were dismissed for the good of the service, and three resigned. Of these one took up the study of law, another went into the timber business, and the third was put in charge of the Negrito Settlements in Zambales. Two others were dismissed for abandoning their work without giving sufficient notice to this Bureau to enable it to send men to take their places. One American field assistant was dismissed for disloyalty and one American forester went on leave and resigned.

The following appointments were made during the year: Mr.

A. D. E. Elmer, botanist, was appointed an instructor in the Forest School and Mr. Antonio Racelis, who had been formerly a ranger in the Bureau of Forestry and had taken advanced work in Forestry in the United States, was appointed assistant forester. Eighteen graduates from the Forest School also received appointments as rangers. In addition to these, three of the most capable rangers were promoted to be forest supervisors. Their duties are to confer with the local forest officers, assist and advise them concerning their work and to carry on such special work as may be assigned by the Manila Office.

Practically all the technical men who might have been induced to come to the Philippines, have been engaged in war work in the United States and for this reason, it was not possible to secure the necessary men to establish the advanced courses at the Forest School.

The permanent force on January 1, 1918, consisted of 1 director, 7 foresters, 1 dendrologist, 1 lumber inspector, 1 wood expert, 3 assistant foresters, 3 forest supervisors, 120 rangers, 8 draftsmen, 41 clerks, and 2 messengers, besides the following employed on a temporary status: 1 nurseryman, 11 laborers, 1 carpenter, 1 varnisher, 48 guards, 2 watchmen, 2 janitors, 1 chauffeur, 1 launch engineer, 1 launch patron, 1 launch sailor, and 1 telephone operator, making a total of 259 employees.

ORGANIZATION.

The reorganization described in the previous annual report has proven very satisfactory and has not been altered. The distribution and location of the clerical sections in the Manila Office were rearranged this past year, however, in order to promote greater efficiency and give more office space. These sections are now more accessible to the general public and still remain under the supervision of the various section chiefs.

EFFICIENCY.

The regular field work has been performed as in the past, but the plan of establishing a corps of rangers to carry on special investigation work had to be suspended owing to the lack of personnel. With the return of the men now with the Philippine Guard, it is planned to again organize this corps, with better prospects of success. Unless this is done, owing to the rapidly increasing work from year to year and the greater detail necessary, it will be impossible to carry on successfully even the regular field work.

Transfers of rangers, disciplinary measures, and recommendations for promotion were acted upon by a personnel committee, composed of the chiefs of divisions and the inspectors in the Manila Office.

FOREST AND SPECIAL INDUSTRIES.

As a whole, the forest-products industries have enjoyed greater prosperity than ever before in the history of the Islands, and despite the enormous prices, the demand far exceeded the supply. It is only fair to state, however, that while the profits of lumber and forest-product dealers in general were large, they were by no means as great as prices would seem to indicate. The reason for this apparent anomaly is the excessive freight charges collected. For a considerable period of the year, it was customary for ship owners to charge ₱46.22 a cubic meter, or else take one-half the selling price of timber shipped from Southern Palawan to Manila. Freight rates on rattan and firewood, the two other principal forest products, were in proportion.

DIVISION OF FOREST MANAGEMENT.

The division of forest management is charged with the use and protection of the public forests of the Philippines. The work consists of issuing licenses for forest products, inspecting the work of licenses, and supervising the work of all field men. Towards the end of the year, instructions were issued by the Secretary of Agriculture and Natural Resources that all licenses of any description were to be issued only from the Manila Office. As each officer in charge of a district had previously been authorized to issue minor-product licenses and timber licenses which did not exceed a stipulated amount of timber, this immediately threw an enormous amount of additional routine work on the Manila section of this division. As a result, it has not been possible for the chief to devote the desirable and necessary time to the special features of his work. The new forest regulations have proven satisfactory and have given an impetus toward the better utilization of the forest, more particularly to those susceptible of being managed in accordance with a definite plan.

The former haphazard method of cutting firewood in mangrove swamps has resulted in the complete destruction of Bakauan, Tangal, and other desirable trees in most of the swamps accessible to exploitation, their places being taken by Api-api and other species which are inferior as fuel. By leasing the swamps under long term licenses or permits, the operators have been given some inducement to cut trees conservatively and to replant vacant areas. As might have been expected, the mangrove swamps which had suffered the most from exploitation, were the first to be put under control. Most of these licensees expect to construct fishponds and will cut firewood merely as a side issue.

A Teak reservation was also established in Jolo by proclamation of the Governor General, dated October 31, 1918. The area included in this reservation contains the largest known stand of Teak in the Philippine Islands.

FOREST DISTRICTS.

District No. 13 was amalgamated with District No. 11 and District No. 14 renumbered 13, in order to keep the numbers consecutive. The headquarters of District No. 11 was transferred to Manila, as it was found that many licensees came to Manila to transact their business and furthermore, this change made it possible to do without the ranger who had entered the Philippine Guard training camp.

The western coast of Leyte being in frequent communication with Cebu, was transferred to District No. 13 (formerly No. 14) as it was found easier for the forest officer at Cebu, who is the officer in charge of District No. 13, to visit this region than for the ranger located in Tacloban.

INSPECTION.

The undersigned visited Districts 3, 5, 6, 7, 8, 10, 12, and 13, and Districts 3, 5, 7 and 11 were also inspected by men from the Manila Office. During the coming year an effort will be made to inspect every district headquarters at least once and as many of the forest stations as the other work of the undersigned and the division chiefs will permit. A much better idea of the efficiency of the rangers and the needs of their stations is obtained through a close personal inspection, than is possible by correspondence; and, furthermore, the rangers, knowing that they and their stations are to be inspected, show greater energy and thoroughness in their field work than if no inspections are made.

SUPERVISION.

Three forest supervisors and one acting forest supervisor were appointed in June, 1918. One of the supervisors entered the Philippine Guard in July, however, and did not assume the duties of his new position. Owing to the entrance of many experienced rangers into the Philippine Guard, supervisors were forced to help in the ordinary routine work of their districts and, for this reason, the inspection of rangers' stations and the checking of their reports has been very incomplete and unsatisfactory.

Arrangements are now being made for the resumption of this work and upon the return from the Guard of these men and the appointment of three additional supervisors, provision for which has been made in the appropriation for 1919, it is hoped to bring this work up to the standard of efficiency originally planned.

LICENSE STATISTICS.

During the year 1918, ordinary timber licenses increased 608 in number over those issued in 1918, there being a total of 2,514 in force. This does not include those which were returned or cancelled. There was also an increase of 62 in the number of gratuitous licenses issued, the total being 1,845. The most noteworthy feature of the increased number of ordinary timber licenses, as indicating the increased volume of business, is the fact that it was almost entirely confined to licenses issued for large amounts of timber. The number of licenses for 100 cubic meters and less than 1,000 cubic meters increased 471 in number, while those for 1,000 cubic meters and over increased 117 in number, exactly double the number issued the previous year.

For minor forest products, a total of 4,519 licenses were issued, an increase of 1,046 over the previous year. As was to be expected, the greater part of this increase was divided between rattan and firewood, these being the two most important minor products. Tables showing in detail the licenses issued during the year will be found in the appendix.

All ordinary forest product licenses issued during 1918, were dated to expire December 31, 1919.

OFFENSES OF LICENSEES.

With the new regulations of the Bureau of Internal Revenue together with those of the Bureau of Forestry, it is easier to punish licensees who attempt to defraud the Government. In the past, it was comparatively a simple thing for a licensee to persuade a municipal treasurer that the tree names which he furnished were the local names for fourth-group timber. The treasurer, being often from a different region or speaking a different language, was unable to detect the fraud and assumed that the licensee was honest in his classification.

During the past year, the Bureau of Forestry has been receiving copies of all invoices and is enabled to determine whether or not the classification is correct. It has been found that many licensees are merely using local names which would reduce the timber from a higher to a lower group. A circular was prepared two years ago giving synonyms of tree names. This is now being revised and will be issued in the near future. Reference to this circular by licensees and municipal officials will reduce the erroneous classification of timber, and will prevent misunderstanding between the licensees and the Internal Revenue agents as well as between licensees and timber buyers.

In connection with the examination of invoices, one or two rangers stationed in Manila have been detailed to coöperate with the Bureau of Internal Revenue in checking timber shipments arriving in Manila.

During the past year, an owner of timber illegally cut on a licensed area disposed of the timber after it had been embargoed by an Internal Revenue officer. He was prosecuted and convicted, receiving a severe sentence. This is the first case of its kind recorded in the files of this Bureau. Licensees who persistently violate the Internal Revenue or Bureau of Forestry regulations forfeit their licenses.

OFFENSES OF NONLICENSEES.

There has been a marked decrease during the past year in the number of complaints received of illegal cutting by nonlicensees. This is attributed to the increased efficiency of the patrol work and inspection of barrios by the forest guards.

FUTURE SPECIAL WORK.

The chief work planned for 1919 will be the putting of the tidal swamps under systematic management as rapidly as they can be surveyed and questions of conflicting ownership settled. The establishment of forest and agricultural zones will be taken up as rapidly as there is personnel available for this work.

CAIÑGINS.

The number of illegal caiñgins reported during 1918 was 776, an increase of 111 over those reported in 1917. This increase is located in the Provinces of Negros Occidental, Samar, Albay and Ambos Camarines. In the case of the first-named province, it was probably due partly to the misunderstood propaganda of municipal officials to plant increased food crops and partly to land hunger, the excessive cost of rice and corn undoubtedly having a stimulating effect. In the case of the last three provinces, while government propaganda was undoubtedly responsible for a part of the increase, the principal factor was the abnormal prices paid for abaka, which is the chief industry of these provinces. As abaka requires a considerable amount of shade, by clearing the underbrush and girdling a few of the largest trees, a virgin forest can be prepared for abaka planting with a minimum expenditure of time and labor.

With the exception of these four provinces, the reports from the rest of the Islands are very favorable, showing that the propaganda which the forest officers have been carrying on against this evil has begun to show beneficial results.

Caiñgins reported during the fiscal year 1918 (January 1 to December 31, 1918).

Province.	Reported by—		Total.	Action of courts—		Total.
	Forest officer.	Municipal president.		Convicted.	Acquitted.	
Abra						
Albay	83		83			
Ambos Camarines	76		76	9	8	17
Antique	13		13			
Bataan	5		5			
Batangas						
Batanes						
Bohol				2		2
Bulacan	23		23			
Cagayan	9		9			
Capiz	4		4	2	2	4
Cavite						
Cebu	49		49	8		8
Ilocos Norte						
Ilocos Sur	3	12	15			
Iloilo	4		4			
Isabela						
Laguna	1		1			
La Union						
Leyte	9		9	7	2	9
Mindoro	42		42			
Misamis	6		6			
Department of Mindanao and Sulu:						
Agusan						
Bukidnon	1		1		1	1
Cotabato						
Davao						
Lanao						
Sulu						
Zamboanga	17		17	8		8
Mountain Province						
Nueva Ecija	3		3			
Nueva Vizcaya						
Occidental Negros	125		125	12	1	13
Oriental Negros						
Palawan	63		63	4		4
Pampanga	18		18			
Pangasinan	9	18	27	14	5	19
Rizal	4		4	1		1
Romblon						
Samar	92		92	6	2	8
Sorsogon	19		19	15		15
Surigao	11		11	6		6
Tarlac						
Tayabas	53		53	24	1	25
Zambales	4		4			
Total	746	30	776	118	22	140

NOTE.—It is most probable that several of the reported cases have already been acted upon, tho this Office has not yet been informed of the fact.

FOREST DISTRICT REPORTS.

The reports from the district officers are generally hopeful in tone and every one seems to be optimistic for the future. Trancazo (grippe), the high cost of living, and high freight rates seem to be common throughout the Philippines.

District No. 1.—Several licensees have tried shipping timber to Manila on schooners and have been very successful. There is considerable risk attached to these shipments, however, because of storms which are very prevalent north of Aparri.

A large lumber company in Manila has purchased a small mill in Cagayan, in order to secure for itself a constant supply of Narra and other woods.

The officer in charge planned to reduce the amount of work incidental to homestead inspection by establishing forest zones, within which no homesteads would be permitted. As he was unable to get the rangers necessary for this work, he was forced to postpone it.

District No. 2.—The rangers in this district coöperated with a representative of the Division of Investigation in establishing forest nurseries.

District No. 3.—A new forest station was established in December at Cervantes for the mutual benefit of the public and this Bureau. A working plan was prepared by Forester Oteyza, aided by 2 rangers, for the Baguio Block and the vicinity of the mines. This plan is intended to insure a continuous supply of timber and firewood for the present and future needs of Baguio City and the mines. The work of fire-protection was continued and the system of patrols has inproved with time and experience. A change was made, however, in the method of patrolling, greater attention being given to cut-over areas, which experience has shown to be most subject to fires and where they do the greatest damage to reproduction. The selection of trees for cutting received greater care than ever before, a total of 8,095 being marked for cutting during the year. An innovation was made in this work by permitting certain of the older and more experienced guards to mark trees, their work being checked, especially in the residential district of Baguio town site, by the forester.

District No. 4.—Apparently the operations of the shipyards at Balangan, Bolinao, were so successful as to encourage the construction of others. There is now a new shipyard at Barrio Lasip, Bolinao, and some talk of establishing another near Agno. The Forest Station at Masinloc was reopened. This was very essential as the region is difficult to reach from other parts of the district; and, furthermore, the sawmill at that place has been relocated by its new owners and is cutting to its full capacity. Owing to the illness of the officer in charge of the district, it was impossible to locate the boundaries of the proposed forest zones in which it will not be desirable to admit settlers. The establishment of a forest zone in eastern and western Pangasinan is very necessary.

District No. 5.—The district forester was transferred in April to the Manila Office and, therefore, the acting chief of the Division of Investigation was appointed to his place. In addition to the work of inspection undertaken during the year, a reconnaissance by students of the Forest School was made in Southern Tayabas. The local ranger force coöperated. A new station was established at Baler to enable a ranger to make inspection trips through the adjacent territory more frequently than has been the case with the nearest forest station at Infanta.

During November and December the boundaries of the proposed Mount Banahao forest zone were reëstablished and patrol trails around Mounts Makiling and Malaraya were repaired.

A new trail from Barrio San Pedro, Calauag, to Guinayangan was also partially completed. Ten kilometers of the trail have been cleared to a width of three meters and it is now ready for leveling and grading where needed. A few big, fallen trees lying across the trail will have to be removed.

The Apad-Kabibihan trail to connect with the above trail, has been almost finished. The trail is already cleared and foot bridges have been constructed across the few streams encountered. There are, however, a few big, fallen trees yet to be removed.

Another proposed trail to be constructed this year is from Barrio Apad to Barrio Capaluan.

These trails will not only facilitate the work of the rangers on their inspection trips, but will also greatly benefit the people living adjacent to them. In fact, the people are already using these trails, even though incomplete.

District No. 6.—The two sawmills in Ragay municipality showed greatly increased activity, due to the high prices which ruled during the year. Practically their entire output was disposed of in Manila. Operations on Derham Brothers' concession on the eastern coast of Ragay Gulf were almost at a standstill. Despite the fact that they had a very large number of logs cut in different parts of their area, they were unable to ship them. Throughout the southern and eastern parts of Camarines and in Albay, the high prices paid for hemp drew laborers to the hemp plantations, leaving the timber licensees with insufficient men to carry on their operations. In Sorsogon, the licensees were able to supply the local demand, but there was little or no timber exported.

The demand for firewood and rattan in this district was unprecedented, as also were the prices paid. Because of the latter, a big output of these products was attained, practically all of it being used locally, however. The caiñgin question was the most serious problem the personnel had to contend with and despite the increasingly effective patrol, there were 210 caiñgins detected during the year. The three principal reasons for this state of affairs were the misinterpretation of Executive Order No. 59, dated July 18, 1917, which led the people to believe that they were lawfully permitted to make caiñgins, and the agitation and support given the caiñgin makers by some local politicians, who encouraged them to declare as private property the virgin forests adjoining their farms. As soon as this land was assessed, the treasurers collected taxes on it. The claimants then submitted their tax receipts as proof of title, when the forest officers attempted to inspect the newly-made caiñgins. The third reason was the enormous prices paid for abaka, which made all land suitable for cultivation of that plant very valuable.

Twelve communal forests were surveyed during the year.

The forest supervisor in charge made a hasty survey of the forests on the west coast of San Miguel Bay for the purpose of determining the suitability of the tract for commercial exploitation on a large scale. Owing to the lack of personnel, it was not possible to carry out a detailed reconnaissance. He recommended that this be done during 1919.

The establishment of two new forest stations is recommended, one at San José, Ambos Camarines, to facilitate the administrative work in the northwestern and western parts of that province and one on Catanduanes.

District No. 7.—The officer in charge of District No. 7 reports that the sawmills in the southern part of the Philippines have established numerous timber yards throughout his district, but that the firewood situation is now more acute than ever before. A thousand rajas (split firewood) sells at ₱36 per thousand, while rajitas (wood but little larger than kindling) retail at 1 centavo a stick. Naturally the swamps are being combed for firewood and anything that will burn is cut. For various reasons there has been a marked increased in the number of caiñgins made. Part of this increase may be attributed to detection because of more efficient inspection and part to the excessive prices now being charged for rice and corn.

District No. 8.—The forester of this district is not so optimistic regarding the caiñgin situation as others have been before him. He finds that it is very difficult to control the non-Christian tribes, as the forest guards fear to incur the enmity of these people. Caiñgin making seems to be on the wane among the settlers along the coast, however, particularly as such caiñgins are usually made by Christians and can be easily discovered from the sea. The provincial government of Sulu has placed the large Teak plantation in Jolo under management, but at present operations are limited only to the prevention of fires and the utilization of defective and matured trees. Work on the establishment of a Teak nursery and plantation on the Pasonanca watershed began on November 1, 1918. This project covers an area of approximately 2 hectares.

There has been an increase in the equipment of several of the sawmills around Mindanao. As a result, it has been difficult for many of them to get sufficient logs, so that one mill was forced to shut down.

The reconnaissance project was completed in connection with the exploration work of the National Coal Company tract on the Sibuguey peninsula.

Communal forests in Mindanao will continue to be unpopular as long as public forests are so abundant, and the towns so far apart.

District No. 9.—The timber shipped during the past year amounted to about 9,500,000 board feet as compared with 8,000,000 board feet in 1917. The increase was entirely due to the larger number of motor schooners which engaged in the hauling of timber; during both 1917 and 1918, many of the licensees could have doubled the amount of timber shipped, had they been able to secure sufficient bottoms. Ipil and Kalantas are the principal species being cut. Maranggo, Akle, Molave, and Narra are also cut, but in very inconsiderable quantities. All the other species are cut only for local consumption, as the high freight charges will not permit of their being exported, except at a loss. There were 353 kilometers of trail notes taken during the year. These notes were taken on trips in connection with the inspection of cutting areas, homesteads and caiñgins. Only 15 caiñgin cases were reported during the year, as against 61 the year before. This decrease is undoubtedly due to the propaganda against caiñgins carried on during the previous year, and the increased patrol and inspection trips.

District No. 10.—As already explained, the western coast of Leyte was transferred to District No. 13.

Lumbering operations throughout the district have been much more active owing to the increased demand and higher prices. Lumber in Tacloban is now selling at ₱120 per thousand instead of ₱75, which was the price a year ago. The officer in charge reports that there has been a large increase in the number of homesteaders settling in Masbate and recommends establishing a forest zone there at an early date. A small, 25 horse-power mill has been established at Dagami, Leyte, and another at Dinagat, Surigao. Caiñgins in the district increased from 111 to 224.

District No. 11.—The ranger at Limay reports that the Cadwallader-Gibson mill is now equipped with 2 large veneer machines. This company is also installing another sawmill on the northwestern side of their concession.

The agricultural portion of Lamao reservation was eliminated from the forest reservation and was immediately applied for under lease. There has been constant trouble from banca makers operating in the interior part of Bataan. It is recommended that the Trade School design a sea-worthy boat such as the Cape Cod dory, which is simple to construct, is easily managed by 1 or 2 men, and is exceedingly stable in rough sea. The manufacture of boats of this character would reduce the present waste caused by the hewing of boats out of the log. The establishment of a Forest Station at Mount Arayat is proposed, not only for the better control of the forest, but also to enable forest officers to supervise the buri swamps to the north of Mount Arayat. The district force has been reduced by enlistment in the Philippine Guard to five rangers and four forest guards. Additional personnel is essential for the proper performance of the field work.

A forest station was constructed at Limay and now serves both as an office and residence for the personnel stationed there.

District No. 12.—A great deal of time has been devoted to the examination of forest lands claimed by individuals who are taking advantage of the opportunity offered by the cadastral survey to include whatever parcels of land pleased them. It is, therefore, necessary for a forest officer to accompany surveyors and take notes of all claims to public forest. There was improvement in transportation facilities in Mindoro during the past year. Unfortunately the Christmas typhoon wrecked one of the boats. Having become accustomed to the improved transportation facilities, the people will look forward to a new launch service. Of course, there is the usual activity among the firewood licensees. As for rattan and other products of the mountain forests, the system of trading posts established by the provincial government has materially aided in their extraction and exploitation. The mountaineers are encouraged to bring wax, rattan, gogo, and diliman to these stores, where they can trade them for supplies at a reasonable price. Licensees are at liberty to compete and are able to do so, by offering better prices than are paid by the provincial stores.

District No. 13.—This district from the very beginning has been handicapped by a lack of personnel. The forest station at Dumaguete has not been opened during the year and the establishment of a new station at Bohol has been indefinitely postponed. There is a considerable number of licensees in the district who are cutting lumber for their personal use only. Sawmills located in the neighboring provinces furnished most of the lumber found in the market.

Ipil-ipil firewood is bringing nearly the same price as Bakauan.

The hard times due to the high price of food has forced people at Cebu to make more caiñgins than usual.

During November and December, the sum of ₱2,000 was made available for the construction of a horse trail between the towns of Tanjay on the east coast of Negros Oriental and Tolong on the west coast. The officer in charge of the district with one ranger and one forest guard made a rapid survey of the ground and then ran a survey locating the proposed route. Owing to the lack of laborers due to the trancazo epidemic and the short time available, he was unable to do any construction work. If money is available, it is proposed to open this trail some time during this year, with the hope that the province will then appropriate money to build a first-class road. This route would reduce the distance between the eastern and western coasts by one-half, make a large stand of timber available, and open up a rich agricultural district for settlement by the inhabitants of Cebu.

THE OFFICE OF THE WOOD EXPERT.

In various lines there has been considerable increase in volume of work in this office. The only radically new work taken up was the coöperation with the Bureau of Internal Revenue in assisting Manila agents to identify timber, firewood and minor products shipped here from provincial points.

BOTANICAL AND WOOD COLLECTIONS.

As no considerable reconnaissance projects were carried out during the year, the number of botanical collections was small, only 377 specimens being received. Of these, however, an unusually large proportion were accompanied by wood specimens, numbering 132 and including numerous species not previously represented in the collections. Also, there was received a lot of nearly 500 wood specimens authenticated by botanical collections of Mr. A. D. E. Elmer. These are from regions little or not at all explored by forest officers and contain a large percentage of new species. Besides scores of wood samples identified, of which no special record was kept, 118 trade samples were added to the collections, many with new names, of which a large percentage were from provinces not previously well represented. To the collection of foreign wood specimens 44 numbers were added, the total now being nearly 1,700.

Phenological reports to the number of 149, containing 1,002 tree names, were received and the new names found in them recorded in the card index of common names.

OTHER ACCESSIONS:

New floor specimens (logs) to the number of 13, all of species new to the collections, have been worked up and installed in the museum. Fifteen new 10-foot planks have been received and installed, besides a number of planks worked up from various lots of old and well-seasoned material acquired during the last few years. Also, a beginning was made to work up a new and more complete set of 6-foot panels of all available material. These now number 81 and are being mounted along the corridors of the offices of the second floor, where they serve at once for ready reference in case of inquiries and as a most appropriate form of ornament.

HAND SPECIMENS AND OTHER SHOP WORK.

The preparation of duplicate hand specimens for sale and distribution, from seasoned material, has kept even pace with other work, so that there are in stock now about 300 species. Over 6,000 hand specimens were distributed during the year, of which number 821 were sold, 2,180 distributed gratis, and 2,736 furnished to the Forest School. Besides specimens furnished to Government agencies and interested private parties in the Islands, they have gone to the following countries: Australia, Borneo, China, Federated Malay States, Hongkong, India, Japan, Mexico, and the United States.

Several stands and racks have been made for exhibiting bamboos, rattans and other minor products in the museum. Metric scaling sticks of native woods were made and furnished to all forest stations where rangers have to do any scaling of logs. Owing to war conditions it has become increasingly difficult and very much more expensive to obtain office furniture, so during the past year all new tables, typewriter stands, etc., required not only for the Manila office but also for forest stations, were made in the shop. While shop-made furniture costs not much less than commercial articles, it has the advantages of being more solidly constructed and more neatly finished than similar articles purchased in previous years. Moreover, it is made almost entirely of thoroughly seasoned material, which is rarely the case with any but the finest grades of furniture from private shops.

IDENTIFICATION, INSPECTION, AND GRADING.

As mentioned above, large numbers of specimens submitted by Government agents and private parties were identified. About 25,000 railroad ties were identified and inspected for railroad companies and other parties. Export lumber to the amount of 500,000 board feet was inspected for grade and species for several private firms.

COÖPERATION.

As mentioned above, there was begun this year a more active coöperation with the Bureau of Internal Revenue in the matter of proper identification of the timber and other products shipped into the Manila market. The Bureau of Internal Revenue agents were furnished a carefully selected set of typical specimens of all the species of woods that commonly come into the market in logs, as well as instructions regarding conspicuous and distinctive features of common species, such as smell, hardness, color, colored deposits in pores, oily or resinous look or feel, etc. In addition to this, rangers from the office accompanied them to identify piece by piece entire lots of timber or large firewood. Several good results have been thus obtained. In the first place, both the Bureau of Internal Revenue agents and the lumbermen have learned in many cases to recognize by their correct official and commercial names such woods as often came in under little-known, local names. Second, this knowledge has begun to filter back even to the wood-cutters and licensees in the provinces, so that the different woods are being more and more listed by their official names in the original invoices, thus simplifying all necessary recording and assessing of forest charges. Finally, because of this better understanding on the part of both revenue agents and licensees, woods that were manifested by little-known, local names and were formerly assessed only as fourth-group timber, are now properly identified and assessed in the third, second, and (in a few cases), even first group, with the result that by a few hours' work the agents and rangers have often added to the proper Government revenues more than their combined salaries for the day.

As in previous years, a number of exhibits were put up in coöperation with the Bureau of Education at Arbor Day and Garden Day celebrations. The most important of these was the Forestry exhibit at the second annual fair of the Central Luzon Agricultural School in Nueva Ecija. Similar exhibits were shipped to several provincial fairs.

REVISION OF GROUPS OF TIMBER TREES.

The proposed regrouping worked out the previous year has been brought up to date as regards both common names and scientific nomenclature and was approved in December. It was published in the Official Gazette in January, 1919, to go into effect on February 1. There was also begun a new tabulation of all local synonyms on record for woods of the first three groups, arranged in alphabetic order, which will be sent out to all internal revenue agents as soon as possible after the promulgation of the new grouping.

COLLECTING AND RECORDING DATA.

A considerable amount of time has been spent in compiling and recording data directly or indirectly connected with herbarium and wood collections and the distribution and local names of species. The local names and distribution of all the tree species of the mangrove swamps have been complied, from herbarium sheets and other sources, for a forthcoming publication. The same work has been completed for the bamboos, for the same purpose. A beginning has also been made toward compiling and maintaining complete lists of the herbarium material in the Bureau of Science of all tree species and other plants furnishing important minor products. These lists will serve in the first place for revising the scientific names of all wood specimens bearing herbarium numbers and also for ready reference when it is desired to know at once the entire distribution of a species without going to the herbarium. This work has been completed for nearly 20 tree families and will be continued as rapidly as possible.

WEIGHTS AND DURABILITY OF WOODS.

Owing to pressure of other work and lack of personnel, it was impossible to work up into form for publication the tables of weights and the data on durability. Meanwhile, some other material has been added and the table will be published during the year 1919.

CATALOG.

A large amount of material has been added during the year to the collection of minor products, some of which has been recorded progressively in the catalog, but otherwise little progress has been made on this work. However, much of the material has been classified during the year and so arranged, as to facilitate greatly the future work of listing. It is expected the work will be completed within the year.

CLERICAL WORK.

Outside of the routine clerical work of the office, much special work was necessary during the year in relabeling floor specimens and planks in the museum, and especially the smaller wood specimens in the office. Three important botanical works were published during the year, all of them involving changes in the scientific nomenclature of numerous tree species, so that it was necessary to relabel hundreds of specimens of all kinds. Also, in order to bring Bulletin No. 14 up to date in this regard, a list of the required changes in names was prepared to send to all forest officers and others using the bulletin and to insert in copies for future distribution.

DIVISION OF INVESTIGATION.

The chief activity of the Division of Investigation during the year 1918 was directed toward the preparation of a series of bulletins on minor forest products and a flora of the woody plants of the Mount Maquiling region.

Minor forest products is a term that includes all forests products other than timber. In the Philippines these minor forest products are of very great commercial value and the Bureau of Forestry is continually receiving inquiries concerning them. While the Bureau has been collecting information on these subjects for many years, there was, up to the beginning of the year 1918, practically nothing in print and such little as existed, was very much out of date. For these reasons, it seemed highly desirable to prepare a series of bulletins on minor forest products which would give valuable information concerning them and serve as texts in the School of Forestry.

BAMBOOS.

Bulletin No. 15, prepared in 1918, gives a general account of Philippine bamboos, keys to the species, descriptions and pictures of the different species, and notes on their uses; also an account of the growth of bamboos in plantations, the rates of growth of mature bamboos, and data on the cost of harvesting.

PAPER.

Bulletin No. 16, prepared in 1918, gives an account of the Philippine forest products that can be used as sources of paper pulp. This subject is one of considerable interest at the present time, as large quantities of paper are used in the Philippines and there is a large, potential supply of pulp material in the Archipelago.

MANGROVE SWAMPS.

Bulletin No. 17, also prepared in 1918, gives a general account of the Philippine mangrove swamps, keys to the species, descriptions and pictures of the various species, and their economic uses. The description of the species is followed by sections dealing with stands of timber in the swamps, the growth of bakauan in plantations, the value of the different mangrove swamp species as firewood, the use of mangrove swamp barks as tanning material, and the economic uses and method of cultivation of the nipa palm. This bulletin should be of great value, as the mangrove swamps in the Philippine Islands occupy between 400,000 and 500,000 hectares, and are a very valuable asset to both people and Government.

PALMS.

During the year 1918 the work of the preparation of a bulletin on palms was largely completed, and this publication will be issued during 1919. It includes a general description of the Philippine palms, keys to, and descriptions of, the species, as well as pictures of the more valuable ones. The economic uses of all the palms, including rattans, are very fully treated.

FIBERS.

The Philippine forests contain a great variety of fiber plants used in the manufacture of cordage, baskets, mats, bags, furniture, and a great many other objects. During the year 1918 considerable work was done toward the completion of a bulletin on this subject, which will be printed during 1919.

OILS, RESINS, AND GUMS.

Oils, resins, and gums in the Philippine forests are numerous and a number of them, such as almaciga, elemi, and lumbang are of great importance. Others are of considerable potential value. During 1918 the bulletin on this subject was more than half completed and will be published in 1919.

MISCELLANEOUS MINOR FOREST PRODUCTS.

The Philippine Forests contain many minor forest products other than those discussed above. These include medicinal plants, dyes, edible plants, ornamentals, poisons, soap substitutes, glues, etc. During the year 1918 considerable progress was made in the preparation of data on these various subjects. These will also be issued during the year 1919.

MINOR FOREST-PRODUCT BULLETINS.

There has long been need of a bulletin dealing with all the minor forest products of the Philippines. The work described above is in preparation for such a publication, which it is planned to issue during the year 1919 in three volumes; the first two dealing with plant and the last with animal products.

The first volume will be reprinted from the plates used for the bulletins on bamboos, paper materials, mangroves swamps, palms, and fibers. There will be, of course, such additions as will be necessary to bring the subject absolutely up to date. It has been considered advisable to print the various sections separately, as well as in the form of a general bulletin. For many purposes, including instruction in the Forest School, a complete account of the minor forest products will be essential; while many people will desire only a single section, and considerable expense will be saved if it is possible to issue to such only the particular section in which they are interested.

Volume two will include oils, resins, and gums, medicinal plants, ornamentals, edible plants, dyes, glues, poisons, and other miscellaneous products. Only one section of this volume will be issued separately; that is, the section on oils, resins, and gums.

Volume three, which has not progressed as rapidly as the others, will include animal products. It will contain an account of the useful birds, mammals, reptiles, insects, and crustacea.

FLORA OF MOUNT MAQUILING.

The students at the School of Forestry have long been handicapped by the lack of a flora to help identify the tree species growing on Mount Maquiling. During 1918, all the time, other than teaching hours, of one of the staff of the Division of Investigation was employed on this project and very considerable progress made toward the preparation of the manuscript. As this work will contain descriptions of the trees in a very representative area, it will not only enable the students to identify the trees which they meet in the forest of Mount Maquiling; but also serve as the basis for a study of the trees themselves.

This study is, of course, one of the most important parts of the course in forestry.

SILVICULTURE.

(1) *Nurseries.*—The site and size of the nurseries have proved to be very satisfactory, as they have been during the last three years. Fifteen species were experimented with in the nursery in the past year.

(2) *Plantations.*—During the past year 3½ hectares were added to the plantations, making a total of 80 hectares now planted with forest species. The cost of managing the nurseries during the past year amounted to ₱441.46 and for the plantations, ₱703.40, or a total of ₱1,144.86.

(3) *Measurement of best trees.*—A large number of measurements of the best trees of the different species have been taken as heretofore. They show the average rate of growth of the different species of trees, the best results that can be expected, and whether or not those trees which begin to grow best continue the best. On account of the large size of the plantations and the fact that the trees are of considerable age, measurements are now being made twice a year instead of four times as formerly.

(4) *Growth studies.*—(*a*) Measurements begun in 1912 and 1914 on a large number of trees in the Maquiling Forest Reserve have been continued. Measurements have also been taken of the trees in the Paete Forest, which were first measured in 1913. Measurements on additional trees have also been begun. These measurements now cover a sufficient period to be very valuable in giving an idea of the rates of growth in these two forests, and it is intended to present them in published form to supplement previous data published by the employees of this Bureau.

(*b*) The above measurements were taken, as well as the rate of growth of individual trees on other plantations. All the trees on a certain area are measured and the rest determined. These measurements have been continued as formerly.

(5) *Silvical leaflets.*—During the past year, silvical leaflets dealing with 75 new species have been prepared, thus bringing the total number of species treated up to 195. These leaflets contain a great amount of information about the habits and habitats of the trees and are intended to furnish a basis for the treatment of the silvicultural requirements of Philippine forest trees.

(6) *Cuttings.*—During the past year 69 species were used in reproducing by cuttings. These were, for the most part, species

which had not been previously tried, but included some that were not successful in past years.

(7) *Seedlings.*—Part of the practice of past years has been the gathering of seedlings from the forest and planting them in the plantations to determine the possibility of using this method in reforestation work. During the past year 18 new species were handled, making a total of 55.

(8) *Reproduction studies.*—The study of reproduction on cut-over forest areas begun in 1913 has been continued as heretofore.

(9) *Lumbang studies.*—As a result of repeated inquiries on the value of lumbang oil, studies have been carried on to determine the yield of trees of different ages in the open and in the stand. Data is being gathered on the individual bearing of all trees during heavy yield and light yield years in order to form a basis for seed selection.

(10) *Cost records.*—During the past year considerable progress was made in determining the actual cost of reforestation work.

FOREST MANAGEMENT, ENGINEERING, AND UTILIZATION.

(1) *Durability tests.*—Work has been continued as formerly. Durability tests of wood species have been kept up and tests on treated and untreated bamboo started.

(2) *Wood preservation.*—As a result of the war activity, studies have been developed wherein the creosotes and tars derived from the distillation of coconut shell show promise of being excellent preservative material for woods in the tropics. Experiments will be carried on in the coming year, provided enough of the distillate creosotes and tars can be obtained.

(3) *Map of the plantations.*—A new map on the scale of 1–1,000 is being prepared and will soon be finished, which will locate the various plots and species much more accurately than has been done before.

THE WORK IN BAGUIO.

The work in Baguio, which is the hill station of the Philippine Islands and the headquarters of District No. 3, comprises the Baguio working circle and the general district administration. The work in the circle is divided into three subheads: general administration; special work on improvement, parks, nurseries and city work; and reforestation. The circle comprises the pine forest within the city reservation, including the mineral district outside the reservation, and all pine stands within a radius of 20 kilometres from Baguio proper.

Data were gathered during the past year for a working plan of the Baguio working circle. The plan is practically completed.

NURSERY.

In the nursery 16,000 cuttings of desirable species were planted this year. Several thousand native herbaceous perennials are now available. The use of native herbaceous perennials gives quick and permanent results in the city ornamentation. The nursery and transplant areas are now sufficiently ample for the work, as most of the villas and private grounds have been fully supplied with plant material and the present nursery stock will be used mostly in the city and park improvement work. A large seed and propagating house has been built to replace the old one. Two new bridges were built on the nursery grounds and the drives and gutters widened and improved. With the construction of a manure tank at the nursery, it is now possible to use stable manure in the planting operations.

Economic trees are being grown at the nursery, the *Cinchona* being of special interest. Twenty-two of these trees are in a healthy condition and over 50 centimeters tall, although a few had to be pruned back because of dying tops. Every effort is being made to bring these plants through, as it is hoped they will furnish a future source of seed. Seeds of economic trees from the United States have given very poor results. For the planting work in 1919, there are now available 25,000 trees, 5,000 shrubs, and 15,000 herbs and vines, comprising in all 337 species and varieties. New trials will be made with ornamentals from Japan, the United States, and Australia.

Excluding 45,000 cuttings used in reforestation work, 4,680 plants were issued from the nursery, of which 1,120 were issued gratis to private individuals, while the rest was used in city and reservation beautification.

CITY AND PARK IMPROVEMENTS.

Ornamental colored shrubs and herbs were planted in masses in Forbes Park and steps were taken for the protection of native birds, at least within the park area, by prohibiting therein all use of air guns, etc., and by building bird houses and shelters to induce the birds to live in and about the park. In the city work practically all the road trees were closely pruned for the typhoon season, although a goodly number along Session Road were blown down, not so much because of the severity of the typhoon as from serious attack of root rot. Plantings were carried on by the Bureau personnel in and about City Hall, Wright Park, Burnham Park, and in the city cemetery.

Considerable trouble has been caused the Bureau by owners of lots not having their boundaries or corners located so as to be readily identified; this has resulted in some cases in the cutting of trees by firewood licensees on private property. Owners of lots have complained to the Bureau and requested action, but, inasmuch as the Bureau personnel is not in a position to locate lot boundaries, complainants have been requested to locate at least the four corners of their property as a guide and to take civil action for trespass.

THE FOREST SCHOOL.

The work at the Forest School during the past year was handicapped by the lack of equipment and a full teaching staff. Vacant positions on the teaching staff could not be filled as no men fitted were available because of the organization of various engineering regiments in the United States. Several Filipino instructors entered the Philippine Guard and the work was kept up by the remaining staff taking on additional work.

If the positions now vacant can be filled, it is hoped that by next year an advanced course leading to a bachelor's degree in forestry can be given, provided the College of Agriculture will coöperate in the instruction and use of the laboratories in physics and chemistry.

The field work of the senior class was delayed as it was planned to use the seniors in conjunction with a big party of experienced rangers on a large reconnaissance, but due to the lack of funds this work will be carried on in the early part of next year before their graduation.

The junior class of the Forest School reported for the summer term on April 15. They were given the usual course in botany, which familiarized them with botanical terms and acquainted them with the more important families and genera. The regular school work was taken up in June with an attendance of twenty-two seniors and twenty-four juniors. Of these, four students were from China. During the first semester, two forestry students were dropped because of difficulty in keeping up with the work. They were handicapped by their lack of training in English. These students were graduates of private schools where Spanish is the principal language.

The Forest School was closed during the entire month of November because of the trancazo epidemic. At one time there were only 13 students strong enough to look after those who were sick. They maintained their system of reliefs and had the sole care of the sick. As the University doctor had not been

Road leading to the Division of Investigation and Forest School, Los Baños, Laguna. On both sides are forest plantations made by the Division of Investigation since 1911.

Student quarters, Forest School, Los Baños, Laguna.

PLATE II.

on duty at the College of Agriculture since the first of July, it was necessary to call in an outside physician for advice and assistance. The school was exceedingly fortunate in having escaped so easily, as only three cases developed dangerous symptoms. By careful nursing, these men recovered without getting pneumonia. The way in which these students took hold of their hospital duties speaks well for the future development of public spirit in the Philippines.

The students carried on their own mess as formerly with an instructor detailed to supervise. Wholesome and nourishing food was furnished by the elected stewards at reasonable price. To augment their mess the students planted a garden and worked it during their spare time.

REFORESTATION.

Due to lack of money, extensive reforestation as planned, was impossible during the past year. But with what money was available, preliminary work was done in the Ilocos Provinces by the ranger in charge of reforestation work, in coöperation with the personnel of that district. The preliminary work consisted in visiting the municipalities and conferring with municipal officials and people, setting aside small plots ranging not over 20 hectares and making clear the terms of coöperation to the municipal authorities. The terms were as follows:

Volunteer planters for the planting period to be secured from the adult residents of the town by the municipal officials. The necessary labor to be hired to carry out the desired amount of planting. At least one guard to be hired by the municipality to keep fires out of the plantations during the dry months. The Bureau of Forestry to furnish the seed and the technical men necessary to carry on the work cheaply and successfully.

As a result, out of the 18 municipalities visited by men of the Bureau of Forestry, 12 forwarded resolutions to the effect that they were willing to coöperate. Approximately 200 hectares were set aside by these municipalities for reforestation. In all 53 cavans of seed were distributed for this purpose. Ipil-ipil seed was used for planting. Small nursery plots are to be established in coöperation with the public schools in their garden work and seed of timber-producing species furnished which, in the opinion of the Bureau, will do well in that locality. The school children are to take care of these nurseries to produce transplants and, after the Ipil-ipil has more or less killed out the cogon, to transplant the nursery stock, during their Arbor Day festivities, to the areas already planted up with Ipil-ipil.

Municipal officials as a whole in the 12 municipalities were very enthusiastic and will no doubt do everything possible to coöperate, the only possible danger being that when labor is necessary it may not be forthcoming. Periodical visits will be paid by the district force to see that care is taken of the plantations now started. Similar work is proposed for the Provinces of La Union and Zambales, but only the preliminary steps have been taken, which consisted of interviewing the municipal officials and outlining the work of the coöperation.

TALISAY–MINGLANILLA REFORESTATION PROJECT, CEBU.

The following table shows the amount of work performed since the beginning of this project in June, 1916.

Year.	Area under Bureau of Forestry.	Area handled.		Area of cogonal planted.		Area caiñgin planted.		Amount of Ipil-ipil seeds broadcasted.
	Has. Ap., 4,095	*Has.*	*Per cent.*	*Has.*	*Per cent.*	*Has.*	*Per cent.*	*Liters.*
1916		666	16.26	352	8.59	52.0	1.27	9,342
1917		971	23.61	854	20.60	67.3	1.65	20,640
1918		1360	33.24	220	5.41	318.7	7.78	5,280
Totals		2,997	73.11	1,416	34.60	438.0	10.70	35,362

Year.	Number of—				Distance boundary.		Distance horse trail constructed.	Distance of foot trail constructed.
	Ipil-ipil seedlings planted.	Lumbang seeds sown.	Bagilumbang seeds sown.	Seedlings set out.	Cleaned.	Planted.		
					Kms.	*Kms.*	*Kms.*	*Kms.*
1916	104,841	56,920	163,930	None	17.2	14.1	.915	3.114
1917	10,628	50,000	245,170	4,136	6.3	6.3	None	None.
1918	None	18,000	393,450	7,791	None	None	None	None.
Totals	115,469	120,920	802,550	11,927	23.5	20.4	.915	3.114

From the above tables, it may be observed that during the past year no work had been performed on trail construction, establishment of boundaries and planting of Ipil-ipil seedlings, due to lack of funds. Also, for the same reason, only 220 hectares of cogonal area were broadcasted with Ipil-ipil seeds.

To offset this, however, there were more caiñgins replanted in 1918 than during the two previous years, the caiñgin area planted being 318.7 hectares as against a total of 119.3 hectares for 1916 and 1917.

At the beginning of last year, the available money for the project was ₱2,900 and the expenditures during the entire year only ₱1,431.42. In view of the amount of work performed with such a small expenditure, it is considered that the administration of this project has been carried out remarkably well.

GENERAL ATTITUDE OF THE SURROUNDING POPULATION.

During the first two years of work in establishing this project, there was a great deal of trouble with squatters, the trouble at times assuming serious proportions, due to the ignorance of the people concerned and their misconception of their rights to the land they were occupying. During 1918, however, there was little or no opposition because it was the policy of the personnel attached to this project to visit the houses of these squatters and explain to them the purpose of the project and the status of the land claimed by them. The coöperation of the municipal officials of Talisay and Minglanilla in the pacification of the squatters was also a very big factor in the peaceful settlement of the question.

WORK PLANNED FOR 1919.

No broadcasting can be done during the next year due to lack of funds. It will be possible, however, to plant in the caiñgin areas the seedlings now growing in the forest nurseries.

BAGUIO REFORESTATION PROJECT.

As this past year was a very poor one in regard to seed production of pine, pine seedlings were gathered with earth balls at an average cost of ₱1 per thousand plants. These were planted in the nursery at 25 centavos per thousand, exclusive of the cost of preparing the ground. Transplants of pine were planted in grassland areas, the transplants being from 30 to 60 centimeters in height and the planting space one and a half meters, at a cost of ₱19.88 per thousand. Tests are being carried out with the local hardwood known as Idog (*Viburnum odoratissimum*) which is used by the natives for hedges and fences. Reforestation work was also continued at the Antamok Creek Source, where 45,000 cuttings were planted during the past year and a count was made of the plantings of the previous year, which gives a percentage of 75 as still living and doing well. Steps were taken to close the planting area to pasturing and a guard was stationed in the neighborhood to keep out fires and animals.

DIVISION OF SAWMILLS AND UTILIZATION.

PERSONNEL.

During the year this division lost one field assistant and four rangers by resignation, dismissal, and death, in addition to three rangers who entered the officers' training camp. The assistant forester assigned to the division was also transferred to aid in handling the large amount of work in the division of forest lands and maps.

The personnel of the division now consists of one forester, one lumber inspector and eighteen rangers. The majority of the rangers are called upon to perform general administrative work under the other divisions of the Bureau in addition to their scaling and concession work, so that time for special studies and grading instruction has been greatly curtailed.

SCALING.

At the time the law providing for the manifesting of timber in the log was passed, arrangements were made to have all the logs scaled by rangers only at the larger mills; while periodic trips were made by the rangers to the smaller mills to scale defective logs, the mill-owners being required to measure and manifest their logs between those visits.

This arrangement, which was made because of the shortage of rangers to handle the work, has never been satisfactory to the interests of either the Bureau or the licensee and new stations have been established as rapidly as men were available in order to provide a permanent scaler for each mill.

The presence of more or less defects in all logs made the manifests, without proper deduction by the companies, unfair to them, and this unsupervised measuring gave rise on some occasions to careless or fraudulent measurements to the loss of the Government.

With the loss of a number of well-trained scalers during the past year, the need of men to carry on this work is again being greatly felt. To develop proper judgment in deducting for defects, the men require at least a month's training under a competent instructor. This training has not been possible to give in all cases with the urgent need for new men in the field to fill the vacancies created by the Philippine Guard and the growing demands in the Bureau work.

The large amount of computation entailed in preparing scale reports renders the work monotonous and unpleasant to many of the men, who prefer the variety of the other forms of field work for which they were originally trained. In order to relieve the rangers for general administrative and investigation work for which they were trained at the Forest School, the appointment of guard scalers is being adopted. These men are generally of grammar and intermediate schooling, who have acquired some knowledge of timber through experience in sawmill and logging work. After receiving thorough training in log defects and the determination of utilization of waste in the mills, they are assigned to scaling work under the supervision of a ranger, experienced in the work. Four of these guard scalers are now assisting the rangers in the scaling and computation work at the larger mills, and more are being selected and trained to assume these duties at all the stations having a large amount of scaling work.

LUMBER GRADING.

The demands made on the Bureau personnel for administrative work by the loss of rangers to the Philippine Guard officers' training camp prevented much further development in grading work.

Several orders for local concerns were inspected by rangers trained during 1917, and five more rangers were given preliminary instruction in classifying the grades other than export at the various mills in southern Mindanao, making a total of 10 rangers who have had preliminary training in grading work. As noted in the report for 1917, the five men receiving instruction during that year also had practice in grading export stock and with some months additional practice and training should develop into efficient inspectors.

With the return of the rangers from the Philippine Guard camp and the entry of the new class from the Forest School, it is hoped that during the coming year further steps can be taken in developing an efficient corps of ranger graders to work under the supervision of an experienced lumber inspector.

UTILIZATION.

During the past year the rangers assigned to the study of grading spent some time in gathering data on the layouts and machinery of the different mills visited by them and securing figures on the cost of operation. This data is being gathered from the various mills with special reference to the larger and best managed mills in order to obtain figures showing the general cost of lumber production in the Islands. Figures so far obtained indicate an everage cost of ₱35 per thousand board feet at the mills.

Complete records are also kept, as far as the figures can be obtained from the companies, of the species cut, the mill output and the shipments to various markets, both local and foreign.

The importation of foreign lumber and possibilities of replacement with local species are being studied for the purpose of creating, as far as possible, a clear field for native lumber as against American and other woods which have entered the Islands in competition more or less continuously since the establishment of the lumber industry here.

LUMBERING.

The sharp revival in lumbering activities and improvement in the market which began in 1917 has continued through the greater part of this year, and while the signing of the armistice in Europe in November created some disturbance and uncertainty among the lumber dealers, conditions have remained good, with excellent prospects for the coming year.

In spite of a large decrease in exports owing to the demand on shipping for other products and the heavy freight rates, the larger mills have continued to operate full time and, in some cases, over time, with a resulting production of some 62,000,000 board feet for the seven larger concession areas as compared to 56,000,000 board feet in 1917. The total production for all the mills in the Islands was approximately 75,000,000 board feet as compared to 60,000,000 board feet in 1917.

While only one new mill was built during the year, replacing one burned in 1915, a second was completed and put in operation and five changed ownership and were put in better running order with an increased and steady output. One of these having cut over the area on which it was located was dismantled and is now being set up on a piece of private forest where it will also be able to utilize government timber.

FOREIGN MARKETS.

In foreign sales, lumbermen have reported numerous inquiries and orders, many of which they have been unable to meet owing to the continued shortage of bottoms during the greater part of the year.

Shipments of lumber during 1918 have decreased some 12,000 cubic meters as compared with 1917, but this can largely be accounted for by the assignment of practically all shipping space to other local products, hemp, copra, oil, etc., and the very high freight rates met with. With the release of shipping for other than war purposes which can be looked for during the coming year, prospects for developing large foreign sales are excellent. The China market, which is capable of being developed into one of the largest purchasers of Philippine lumber, can be supplied more readily with the release of shipping; and a reduction in freight rates will permit the placing of lumber in that country at marketable prices.

An indication of the possibilities of development of the markets in China, particularly of the Douglas Fir market in South China, is found in the United States Commerce Reports of

November and December, 1918, and in reports of the lumber markets in Tientsin and Hankow. The following extracts are taken from the latter report:

> Hongkong is not so large a market for softwood lumber as Shanghai. Various factors contributed to distinguish the timber trade of Hongkong from that of Central and North China. Owing to the more tropical climate of the south, a wood is required that will not shrink and that is able to resist the ravages of white ants and other insects. In South China, American and Japanese softwood lumber has also to face stronger competition from the various hardwood timbers of the East, such as teak, Philippine, and Borneo woods.
>
> ### CHIEF FOREIGN WOODS USED.
>
> Owing to high freights and other causes the quantity of Douglas fir imported last year was smaller than usual and can not be taken as representative of the requirements of the markets for this wood. A large amount of teakwood is used by the shipbuilding and repairing companies for decking and other purposes. Teak is also used for making furniture. This timber is imported from Siam and Burma, usually in the form of logs to be sawn up as required. *The Philippine Islands produce timber of excellent quality. Lauan timber from the Philippines is one of the chief competitors of Douglas fir, while Philippine Apitong is also used largely for flooring. A small quantity of lumbayao is also imported,* principally for the manufacture of furniture.
>
> Douglas fir imports consist almost entirely of heavy beams, planks, boards, and bridge timber.
>
> ### USES OF DOUGLAS FIR.
>
> The Douglas fir imported into Hongkong is used by the shipbuilding and repairing companies chiefly for the lining of cargo holds and for interior work in cabins, ceilings, bunk sides, etc. In the construction of houses, Oregon Pine is employed mainly for siding. The Chinese require only rough timber for building purposes. Oregon Pine is not suitable for flooring on account of the ravages of white ants. A fairly large amount of Oregon Pine is used for staging. Junks and sampans have been made from this wood, but Foochow Pine is generally used for this purpose.
>
> The average buying price for Douglas fir before the war ranged from $18 to $22 gold per 1,000 superficial feet landed in Hongkong. Owing to high freights across the Pacific, the present price is around $99 gold. This price is very high compared with that of other woods. As a result, a larger proportion of Foochow Pine has been sold. In normal time Douglas fir can compete with Foochow Pine in price and at the same time is superior in quality. *Lauan timber may be considered the chief competitor of Douglas fir in the Hongkong market.* Other things being equal, lauan is usually preferred, owing to the poor grades of Douglas fir imported. In 1916 both woods were selling for about 6 cents Mexican per foot. As a rule, Douglas fir is cheaper and for certain purposes is found more suitable. California redwood is a favored timber, but generally its price is too high. It is not affected by the white-ant pest and the opinion was expressed that British Columbia red cedar also should prove a suitable wood for the South China market for the same reason. It was reported that the prices of

British Columbia lumber have been too high as compared with lumber from Oregon and Washington, but this may be attributed to the fact that the Canadian mills have never been properly organized for this business.

HANDLING OF LUMBER IMPORT.

The trade in timber with Hongkong is in the hands of a few firms, most of whom have long-established connections with mills on the Pacific Coast of North America and in other producing countries. These firms have their own piling grounds at the principal centers and well-organized systems of distribution through native dealers covering all important points in the interior.

As Philippine woods can be substituted largely for the abovementioned uses of Oregon Pine, it seems evident that Philippine and Borneo woods, together with teak and the cheaper Foochow Pine, should occupy principal positions in this important market.

In northern China the reports show that softwoods from America, Japan and China, together with oak from Japan, at present occupy the chief place in the lumber market, although the high freight rates have greatly reduced imports from America. Philippine woods are chiefly imported into Tientsin and vicinity for flooring and interior finish.

However, the importation of 733,172 cubic feet of hardwoods into Tientsin and 188,309 cubic feet into Hankow during 1917, when transportation was difficult and expensive, together with the variety of uses for which Philippine lumber is useful, indicates the excellent prospects available for an active campaign in this region.

Inquiries from Japan, Australia, and South Africa during the past year, while not giving special promise of much business at present, should lead to further introduction of Philippine lumber in those countries and the establishment of a permanent trade.

MARKETS.

With a total production of some 75,000,000 board feet from the sawmills of the Islands, the local markets have continued to be the chief purchasers, taking 91 per cent as against 80 per cent during the previous year, or about 68,000,000 board feet.

In addition to the native lumber, there have been imports amounting to 14,879 cubic meters or 6,308,700 board feet from the United States and other countries, of which 7,387 cubic meters or 3,135,000 board feet were Oregon Pine and Redwood, as compared with 2,768 cubic meters or 1,174,000 board feet in 1917.

The amount and value of lumber and timber exports for 1918, as compared with 1917, are shown in the following table:

	1918			1917		
	Cubic meters.	Board feet.	Value in pesos.	Cubic meters.	Board feet.	Value in pesos.
To United States:						
Timber	31	13,144	1,015	....	....	....
Lumber	6,999	2,967,576	376,153	12,488	5,294,912	483,215
Total	7,030	2,980,720	377,168	12,488	5,294,912	483,215
To Hongkong:						
Timber	169	71,656	10,978	1,166	494,884	72,842
Lumber	3,858	1,635,792	80,066	8,310	3,523,440	215,645
Total	4,027	1,707,448	91,044	9,476	4,017,824	288,487
To China:						
Timber	....	....	....	223	94,552	8,730
Lumber	5,477	2,822,248	166,084	6,453	2,736,072	121,009
Total	5,477	2,822,248	166,084	6,676	2,830,624	129,739
To Japan:						
Timber	....	....	....	26	11,024	1,501
Lumber	10	4,240	1,453	23	9,752	1,995
Total	10	4,240	1,453	49	20,776	3,496
To Australasia:						
Lumber	13	5,512	486	52	22,050	1,646
To Guam:						
Lumber	11	4,664	810			
Grand total	16,568	7,024,832	636,985	28,741	12,186,186	906,583

Although a certain amount of the increase in Pine imports may be attributed to failure of local purchasers to appreciate the comparative qualities of pine and local lumber, a large portion of the lumber has not been sold in the Islands, but has been reëxported to India and the Dutch Indies.

Experiments carried on by the Bureau of Forestry during the past 10 years indicate that Oregon Pine and Redwood are no more than equal to and, in some cases, poorer than common native lumber in point of durability and structural qualities.

As the continued use of American lumber appears to be largely a matter of more familiarity with many users and partly in consequence of the failure of local mills to cut some of the larger sizes required for special purposes, a proper campaign by the lumbermen for the business formerly held by foreign lumber should do away with this competition.

The U. S. Army Quartermaster Corps was formerly probably the largest user of Oregon Pine and Redwood in the Islands, but after carefully investigating the records and comparing them with those of the native species, the Department has turned entirely to native lumber.

The contract awarded by the Quartermaster during 1917 for native lumber was completed during the present year and during the latter part of the year, new bids were called for and another contract for 3,000,000 board feet awarded to a local company.

Imports from the United States, January to December, 1918.

	Cubic meters.	Board feet.	Value in pesos.	Duty.	Totals. Cubic meters.	Totals. Board feet.	Totals. Value in pesos.	Totals. Duty.
Ties, 1,305	72	30,450	₱659		169	71,578	₱5,559	
Timber	97	41,128	4,900					
Pine lumber	4,908	2,080,992	138,962		6,235	2,643,640	202,008	₱2,667
	1,327	562,648	63,046	₱2,667				
Redwood	1,152	488,448	28,504					
Cedar lumber	499	211,576	7,278					
Cedar box shooks			64,383					
All other lumber	3,198	1,358,832	90,715		4,008	1,738,312	117,084	2,179
	895	379,480	26,369	2,179				
Total lumber	11,974	5,076,976	419,252	4,846				

OTHER COUNTRIES.

	Cubic meters.	Board feet.	Value in pesos.	Duty.	From—
Miscellaneous timber	7	2,968	₱680	₱14	Canada.
Miscellaneous lumber	742	314,608	16,357	1,485	
Miscellaneous timber	17	7,208	221	32	China.
Miscellaneous lumber	46	19,504	694	136	
Pine lumber	17	7,208	608	84	Japan.
Cedar shooks			3,889	583	
Do			1,738	434	Spain.
Cedar timber	50	21,200	1,187	99	Dutch Indies.
Miscellaneous lumber	26	11,024	752	53	French Indies.
Do	120	50,880	3,456	343	British Indies.
Do	1,664	705,536	21,470	429	British West Indies.
Timber	20	8,480	1,589	41	Germany.
Pine lumber	2	848	15	4	
Total	2,736	1,159,064	53,591	3,686	

TOTAL OF ABOVE TABLES.

	Other countries. Cubic meters.	Other countries. Board feet.	Other countries. Value in pesos.	United States. Cubic meters.	United States. Board feet.	United States. Value in pesos.
Miscellaneous timber	44	18,656	₱2,490	169	71,578	₱5,559
Cedar timber	75	31,800	2,122			
Miscellaneous lumber	2,598	1,101,552	42,729	4,088	1,733,312	117,084
Pine lumber	19	8,056	623	6,235	2,643,640	202,008
Cedar box shooks			5,627			64,383
Cedar lumber				499	211,576	7,278
Redwood lumber				1,152	488,448	28,504
Total	2,736	1,159,064	53,591	12,143	5,148,554	424,811
Grand total of imports				14,879	6,307,618	478,402

Imports of Oregon Pine from United States; past 5 years.

Year.	Cubic meters.	Board feet.	Value in pesos.
1914	30,441	12,906,984	₱650,292
1915	3,281	1,891,144	58,128
1916	1,952	827,648	58,765
1917	2,768	1,178,632	110,924
1918	6,235	2,643,640	202,008
Total	44,677	18,948,048	1,080,117

While Manila is the chief lumber market in the Islands owing to its importance as a distributing center, the ports of Cebu and Iloilo in the Visayas, and Zamboanga in Mindanao received large shipments during the year, in addition to the local demand supplied directly from the sawmills and smaller licensees.

The steady settlement and development of Davao Province has led to the establishment of two yards in the town of Davao, which is rapidly developing into an important center.

In spite of the uncertainty created among some of the lumber dealers by the signing of the armistice in Europe, prices have continued high throughout the year with increases over 1917 of 20 to 30 per cent and in some cases as high as 40 and 50 per cent.

DIVISION OF FOREST LANDS AND MAPS.

SECTION OF PUBLIC FOREST-LANDS CASES.

Several short-comings have been observed in handling the subjects pertaining to this section, due mainly to the lack of understanding and coöperation between this Bureau and other Government branches connected with the registration of titles to lands claimed by private persons. In order to obviate these weak points, it is suggested that the following coöperative plan be recommended to the Director of Lands and the Attorney-General respectively:

Bureau of Lands.—Both Government and private qualified surveyors should be required to sketch on the plans to be registered all the different features of the land such as roads, trails, rivers, creeks, hills, etc., and especially the soil cover, by indicating the different areas as follows:

Forest or bosque	Soil covered with timber of whatever species.
Brush or matorral	Soil covered with shrubs or brush or mixed with cogon, i. e., "Parang".

Uncultivated or inculto	Uncultivated land.
Pasture or grass Pastos o cogonal	Soil covered with grass or cogon.
Coconuts, rice, sugar, fruit trees, hemp, etc Cocos, arroz, caña dulce, arboles frutales, abaca, etc	Cultivated land shall be indicated by the crops to which it is ordinarily devoted.
Mangroves, fishponds, salt works, etc Nipa, mangles, pesquerias, salinas, etc	Lands affected by tides shall be indicated with these words, as the case may be, and in accordance with high-tide line.
Town lot, street, plaza, etc Solar, calle, plaza, etc	Urban lands shall be indicated with these words, as the case may be.

With the exception of urban maps, a blue print copy shall be forwarded to the Director of Forestry.

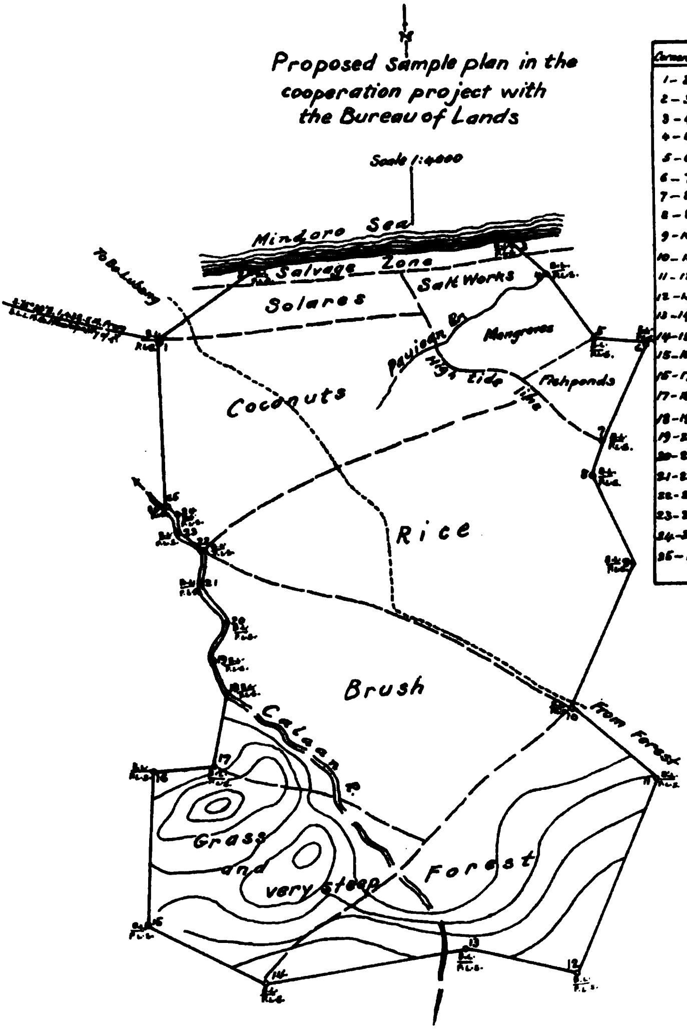
Cadastral surveys cover extensive areas, parts of which often include large parcels of forests, valuable not only because of their commercial importance, but also because of the necessity of conserving them as such. In view of these facts, it is advisable to inspect such areas in order to produce the necessary evidence in case of opposition. Generally, between the date of receiving the notice of hearing and the date when it is to be held, there is not time enough for carrying on the reconnaissance work and to prepare the evidence in connection with the parcels against the registration of which the Bureau of Forestry is entering opposition. For this reason, there should also be forwarded to the Director of Forestry two copies of the boundary map in each cadastral case, as soon as the plans are completed and at the time of sending the application to the General Land Registration Office or even before, if possible.

In cases where opposition by the Director of Forestry is necessary, copies of the sheets pertaining to the parcels to which opposition is to be made and the names of the claimants thereof, shall be requested in writing from the Director of Lands.

Office of the Attorney-General.—A new phase is presented in the theory on which the Hon. Justice Malcolm bases the decision of the Supreme Court No. 13298, O. G. No. 52, December 25, 1918, as regards the legal value of evidence produced at the hearing by rangers and the opposition in mere form by the Attorney-General in the name of the Director of Forestry, and which proposes as a remedy, in behalf of the Government against private claims, that the Director of Forestry should produce before the court convincing proofs that the land is more

Proposed Sample plan in the cooperation project with the Bureau of Lands

Scale 1:4000



Corners	Bearings	Distances
1 – 2	N.54°40'E.	109.20m
2 – 3	N.83°05'E.	257.60
3 – 4	S.52°30'E.	42.00
4 – 5	S.35°30'E.	86.40
5 – 6	S.87°55'E.	48.00
6 – 7	S.23°50'W.	110.80
7 – 8	S.24°05'W.	34.00
8 – 9	S.23°30'E.	103.20
9 – 10	S.25°0'W.	148.00
10 – 11	S.58°10'E.	112.00
11 – 12	S.22°30'W.	207.20
12 – 13	N.75°05'W.	109.20
13 – 14	S.75°30'W.	204.00
14 – 15	N.61°53'W.	125.00
15 – 16	N.2°38'E.	149.20
16 – 17	N.84°07'E.	53.00
17 – 18	N.10°20'E.	76.00
18 – 19	N.30°15'W.	29.00
19 – 20	N.27°20'E.	33.00
20 – 21	N.38°10'W.	45.00
21 – 22	N.7°28'E.	40.00
22 – 23	N.85°05'W.	25.00
23 – 24	N.4°05'W.	20.05
24 – 25	N.46°57'W.	18.00
25 – 1	N.2°07'W.	158.00

valuable for forest than for agricultural purposes. This makes it advisable to adopt a new procedure in regard to the manner in which forest officers should produce their evidence and also as to how the provincial fiscal should file the opposition.

Reports of forest officers shall contain, in addition to the information required in the present procedure, the amount of the timber stand, the approximate market value, a discussion of the soil and subsoil, its adaptability for cultivation, and a statement as to the purpose for which the land is better fitted according to the comparison previously made.

This report shall be made separately from the letter of transmittal to the provincial fiscal, with the heading "Technical Report on the forest inspection of Lot .... Expediente No............ G. L. R. O. Rec. No. ...." and shall be signed by or in the name of the Director of Forestry.

Should it appear from the preliminary information that opposition is necessary and that there is not sufficient time for the preparation of evidence on the day of the trial, the officer who made the inspection shall wire the provincial fiscal requesting the suspension of the trial until the evidence is prepared. The Attorney-General, by request of the Director of Forestry, shall file the necessary opposition, submitting during the trial the technical forest report with the certification of the Director of Forestry and, if necessary, with the corroboration of the forest officer who made the inspection, and to this end the fiscal representing the Director of Forestry shall instruct and examine the witness in regard to the facts contained in the report.

On every case in which the Director of Forestry files an opposition, the Attorney-General should inform him with the least possible delay as to the decision of the court, and, in case of failure, as to whether or not an appeal should be instituted in accordance with the evidence in the proceedings.

The following table shows the status of the claims received during 1918:

Number of notices of hearings.

	Number received.	Action taken.	No action necessary after inspection.	Pending decision of court.	Number of hectars adjudicated to the Insular Government.
Cadastral	19	5	4	1	....
Ordinary	1,216	179	104	75	819
Grand total	1,235	184	108	76	819

SECTION OF PRIVATE FOREST-LANDS REGISTRY.

Eighty-four parcels of land with a total area of 43,213 hectares, 17 ares, and 26 centares, have been applied for, for registration in accordance with the provisions of section 1829 of the Administrative Code, and examined for the information of the Collector of Internal Revenue.

Several applications for lands containing heavy timber stands and other forest products have also been received together with land tax declarations as the title of ownership, or documents showing that the land was purchased, or a sworn statement in local dialect made by a witness to justify the ownership of the claimant. Such applications have been returned to the interested parties.

Section 1513 of the Administrative Code is so ambiguous that it gives room to different interpretations. On the one hand, it refers to lands, the titles to which are not registered and, on the other, it seems to admit a mere claim of ownership. For this reason the Collector of Internal Revenue was requested to amend said section, making it clearer and shorter, so as to give the Director of Forestry the right to investigate the forest conditions of the land in connection with the claimed title to the same; and also the right of deciding the questions of fact relating to said lands, which decision, once approved by the Department Head and as long as the claimant does not present the proper title, shall be final for administrative ends. With this amendment the unfounded claims that so frequently hinder and disturb the smooth running of forest management may be eliminated and all interests, both private and governmental, be better assured.

In the course of forest administration it has been alleged in several cases when private owners were required to register their lands, that section 1829 of the Administrative Code was not applicable to them in view of the fact that their property was agricultural and not forest land, for the reason that greater or less parts of them were cultivated, even though the remaining portion contains merchantable timber, firewood, and other forest growth.

As the object of the registration provided in the above-mentioned section is to regulate the transportation of forest products and to prevent frauds that may be committed by alleging that the products were collected from private lands when they were really gathered from public lands, an amendment to the effect that the phrase "*or containing forest products*" be added to the words "*forest land*" will make the above-mentioned section clearer and more comprehensive.

There is no provision in the present legislation authorizing the Director of Forestry to interfere with or establish regulations regarding the use of forest cover on private lands, and inasmuch as several private forest lands will necessarily be included in future projects of forest reserves and protective zones, it is very important to enact a law making the above-mentioned section 1829 more comprehensive, to the effect that a private owner of forest land included in protective forest zones, shall be economically the owner of said areas and may freely dispose of the property, but the exploitation of the same shall be regulated by the Director of Forestry, by means of a plan approved by the Head of the Department, to warrant the permanency of the forest, without any further intervention from the Bureau of Forestry, except when it is necessary to exercise inspection and supervision to insure the conservation of the forest cover.

The following table shows the private woodlands registered up to December 31, 1918:

Registered private woodlands.

Calendar year.	Number of—			
	Parcels.	Hectares.	Ares.	Centares.
1900	420	20,643	68	51
1901	201	68,886	06	95
1902	23	16,412	27	44
1903	3	1,805	94	65
1904	8	29,228	47	82
1905	12	6,681	68	89
1906	21	12,736	95	24
1907	17	28,888	73	05
1908	10	585	97	53
1909	14	6,215	86	62
1910	4	8,658	85	22
1911	5	5,533	67	26
1912	14	6,552	84	89
1913	26	15,229	58	36
1914	16	23,230	06	07
1915	27	13,804	36	95
1916	37	51,663	77	49
1917	48	7,985	68	39
1918	84	43,218	17	26
Total	990	360,802	12	59

SECTION OF PUBLIC LANDS APPLICATIONS.

The good intentions and the proposed plan of making a careful inspection of public lands applied for, in order to reduce to a minimum the number of applications pending for inspection at the end of the year, could not be carried out completely, not only because of the upset which the call to the Philippine Guard gave the field personnel, but mainly because of the trancazo epidemic, which prevented both inspectors and applicants from going to the land to be inspected.

In order to counteract as much as possible these difficulties, and putting aside the proposed demarcation of agricultural and forest zones, all the available field personnel were assigned during the month of December to the inspection of public lands applied for, with the object of reducing as much as possible the accumulation of this work.

Table I in Appendix C shows the distribution of applications in the different provinces of the Archipelago, the summary of which is as follows:

Applications on hand during 1918		11,722
Certified for agriculture	6,134	7,046
Certified for forestry	670	
Returned uncertified	242	
Total pending December 31, 1918		4,676

More than 40 per cent of these 4,676 pending applications have been already examined during the month of December and are only pending for the reports and recommendations of the district officers, which have not been received in Manila for certification on account of the above-mentioned causes. Further, at the direct request of applicants who were helped by forest officers in making the application, 689 parcels of public land have been examined, the certificates of which are now ready for issuance as soon as they are requested by the Director of Lands.

SECTION OF FOREST ZONES, RESERVES, AND COMMUNAL FORESTS.

On account of the same reasons set forth in the public lands application section, a great part of the work of demarcating forest zones and establishing reserves has been suspended.

Further, the proposed proclamation of certain concessions operated under contract as forest reserves could not be carried on in view of the refusal of the Governor-General to proclaim them; as, according to the opinion of the Attorney-General, "it would result in the Government exercising the right of eminent domain for the benefit of a private corporation under no obligation to serve the public, which is unconstitutional."

Now, though it is true that the chief object of requesting the proclamation of these two reserves was to protect the exploitation of the areas in question and to solve the administrative problems connected with them, yet the benefits derived from this action could be no greater for the licensee than they would be as regards the protection of a public property on which depends to some extent the economic welfare of the Islands.

If the request for the proclamation of these reserves had been made for areas not occupied under license agreement, it would not have met with any objection regarding the benefits redounding to a private enterprise, yet immediately after proclaiming a reserve, the Director of Forestry could make use of his authority to recommend the granting of a license agreement, if proper administration of the area required it.

The lumber industry is destined to become one of the first industries of the Philippines if it is given due consideration. The intensive exploitation of a forest to obtain the greatest possible return of profits can only be attained by modern methods at great expense of time and money and unless the Government is willing to carry out such exploitation on its own account, or to grant the public forests to private owners, it is absolutely necessary that greater authority be vested in the Director of Forestry for the protection of the forests of the Philippines and to assure their perpetuation in a productive condition by means of wise utilization.

It is estimated that only 25 per cent of the total area of the exploitable forests can be developed under the old methods employed by ordinary licensees. The remaining 75 per cent is inaccessible to such methods, and modern machinery is required, not only for the manufacture of timber, but also for the transportation of logs from the forest to the mill, as without such apparatus it is impossible to realize the millions of pesos represented by the timber left unused.

In the first case, licenses are usually issued for periods of from one year to two years, though in most cases they are renewed, and only such conditions as will prevent the destruction of the forest and of certain species are imposed on them. In the second case, the term is for a period of twenty years and under a contract by which the licensee is given an exclusive right to buy and collect timber and other products, imposing on him certain obligations which are specified in the contract.

With the guaranty of this contract, and in order to comply with the obligations imposed on him, the licensee has to invest great sums of money in machinery and the necessary organization to obtain profits proportioned to the productive capacity of the forest, so that to induce a private company to invest its capital on land to which it can acquire no property rights, the Government must in justice guarantee to protect the company's operations.

Meanwhile, the caiñgin makers, in their eagerness to find land suitable for their purposes, invade the forest areas and proceed, contrary to law, to fell and burn the stand of timber; which infraction is penalized by twice the ordinary charge on the forest products illegally destroyed and imprisonment not to exceed thirty days, at the discretion of the court.

These illegal occupants of the land constitute a continuous and dangerous menace against the interest of the licensee as well as of the Government, for their practice destroys great areas of timber on which the licensee has based his investments and the Government suffers a double loss, on the one hand of the income derived from the sale of the timber and, on the other hand, through the expenses incurred in the trial of the culprit and his maintenance in prison.

Beside the losses mentioned, there arise continually serious conflicts between the licensee and these occupants of the land, who in the course of the exploitation of the forest hinder the licensee in hauling timber and demand of him rent or indemnity for damage to their supposed property.

In order that the Director of Forestry, as a representative of the Government, may guarantee to the party of the second part the development of future operations which are necessary for the purpose of complying with the obligations imposed on him by the contract, he should have full control over the area which was granted him for exploitation.

One of the most important tasks preliminary to the proclamation of reserves is the survey and location of monuments with the approval of the Director of Lands, but sometimes there are no surveyors available in the Bureau of Lands, though the establishment of reserves requires the intervention of technical personnel from the Bureaus of Lands and Forestry. In order that this Bureau may carry on its projects at any time, it is strongly recommended that four rangers of this division be qualified as surveyors, who will carry out all legal surveys, according to the methods approved by the Director of Lands, whether for the establishment of reserves or for the exclusion of forest areas, to the application of which the Director of Forestry has entered opposition and which were not granted to applicants by the Court of Land Registration.

These rangers will be previously detailed to the Bureau of Lands for a period of not less than six months in order to acquire experience in the handling of instruments, computation, and plotting in accordance with the methods employed in said Bureau.

The following is the result of the work carried out by this section during the year 1918:

Forest Reserves. Teak Reservation.—Two thousand five hundred and thirty-three hectares, 26 ares and 39 centares, Barrio

Suu, municipal districts of Lati, Panaman and Gitong, Province of Sulu, Jolo Island.—Proclaimed on October 31, 1918. This reservation was made to protect the largest stand of teak in the Philippines and place it under more efficient management.

Forest Station Reserve.—(One hectare) in the Mindanao Lumber Co.'s area, Barrio Naga-Naga, municipal district of Kumalaran, Province of Zamboanga, Mindanao Island.—Requested for survey to the Director of Lands on April 25, 1918.—Pending for technical description for its proclamation.

Forest Station Reserve.—(One hectare) in the Port Banga Lumber Co.'s area, municipal district of Bañgaan, Bañgaan Island, Province of Zamboanga.—Requested for survey to the Director of Lands on October 21, 1918.—Pending for technical description for its proclamation.

Forest station Reserve.—(Five and eighty-five hundredths hectares) Barrio Maribojoc, municipal district of Kolambugan, Province of Lanao, Mindanao Island.—Requested for survey to the Director of lands on March 5, 1918.—Pending for technical description for its proclamation.

Reserve for the protection of mangrove swamps.—(Ten thousand hectares) municipalities of Dumangas, Barotac Nuevo, and Banate, Province of Iloilo.—Requested for survey to the Director of Lands on July 22, 1918.—Pending the technical description for its proclamation.

Reserve for the protection of the basin of Himugaan River in order to facilitate forest management, municipalities of Sagay and Cadiz, Negros Occidental.—Proclamation disapproved on July 11, 1918.

Extension of the Forest Station Reserve of the Cadwallader-Gibson Lumber Co., with the object of facilitating forest management.—Proclamation disapproved on July 25, 1918.

Forest Zones.—The forest zones which were changed and demarcated with a view to propose their definite proclamation as forest reserves, are those of Mounts San Cristobal and Banahao in the Provinces of Tayabas and Laguna, and that of Mount Arayat in the Province of Pampanga.

Forest devastation in these regions is increasing considerably to the detriment of the surrounding agricultural regions, and in order to insure the preservation of the forest for the benefit of agriculture and to supply local demand for forest products, their immediate proclamation as reserves is required as hereinafter indicated:

Forest Zones of Mounts Banahao and San Cristobal.—Radical changes have been made in the boundaries of the forest zone on the Laguna side. The former boundaries included a vast extent of agricultural and cultivated country. Abaka, coffee, and coconut plantations of long standing, lands at present cultivated, and populated barrios were generally excluded. On the Tayabas side there were some slight changes necessary. The present proposed boundaries may have included parcels of claimed lands; but as the country above them, especially that on the Laguna side, is fit only for forestry purposes, their registration, in case such should be applied for, will be opposed regardless of vegetation found thereon.

In the course of this work, the people in the surrounding country were informed of the establishment of a reserve on the mountains. They were naturally all opposed to it, especially those who still have lands inside, but after they had been brought to see and believe the benefits to be derived from the area when established as a reserve, they seemed to feel satisfied, and some even expressed their willingness to give up the claims on their parcels.

As the boundaries and corners are made out, the country to be excluded is satisfactory to the surrounding community, for almost all their plantations, especially those made years ago, are excluded, and if any are included they are only those for the most part made recently, namely: One to four years ago, and on steep and rough country. This is especially true on the Laguna side of the proposed reserve. On the Tayabas side there are still included potential agricultural areas, but these are heavily wooded, constituting the only good forest in that region, the retention of which is of indispensable necessity for the nearby community. The approximate area of the proposed reserve is 13,400 hectares. The forest station at Lucban, Tayabas, is in charge of the protection of the present forest zone.

It is, therefore, recommended that a provisional reserve be proclaimed on the Mountains of Banahao and San Cristobal from descriptions furnished by this Bureau, awaiting the technical description of the Bureau of Lands.

Forest Zone of Mount Arayat.—It is estimated that 80 per cent of the utilization of timber, firewood, and charcoal on Mount Arayat is fraudulent. By comparing the forest charges collected by the municipal treasurers with the firewood that is being constantly gathered, this was found to be true.

The sugar and rice mills in the municipalities of Magalang, Arayat, and others in the vicinity are using fuel from Mount Arayat and it is estimated that more than 10,000 cubic meters of firewood are consumed in the six months during which their operations last.

There are several firewood licensees in this region, but they are mere instruments as a precaution against any prosecution or are used to prevent others from collecting firewood on the same area.

Furthermore, caiñgin makers are illegally destroying large forest areas, making a failure of the policy established by this Bureau of annually granting caiñgin permits and imposing as a duty on the caiñginero the planting of Ipil-ipil seeds, furnished by this Bureau, on the land to be abandoned and before clearing another parcel.

In order to prevent such violation and to properly regulate the use of forest products and to insure a constant supply, a patrol trail has been established surrounding the base of Mount Arayat.

The approximate area of this reserve is 4,575 hectares.

For the administration and protection of this proposed reserve, a forest station will be established in Arayat with a ranger and an assistant guard.

Communal forests.—In accordance with the provisions of the law, 63 parcels with a total area of 6,965 hectares have been located, studied, and designated as communal forests.

The following tables show the distribution of communal forests by provinces and the total of those established up to December 31, 1918:

Communal forests established from 1908 to 1918.

Years.	Parcels.	Hectares.
1908	17	5,869
1909	21	8,279
1910	19	5,762
1911	47	13,592
1912	59	10,790
1913	25	3,862
1914	45	6,790
1915	94	13,049
1916	107	15,627
1917	84	10,035
1918	63	6,965
Total	581	100,120

Settlement of communal forests established up to December 31, 1918.

	Parcels established.		Total.	Municipal townships or rancherias.	
	Before 1918.	During 1918.		With C. F.	Without C. F.
Abra	20	0	20	13	6
Albay-Catanduanes	11	1	12	9	13
Ambos Camarines	30	4	34	26	12
Antique	3	2	5	3	9
Bataan	13	0	13	12	0
Batanes	0	0	0	0	6
Batangas	0	1	1	1	23
Bohol	11	14	25	18	17
Bulacan	0	0	0	0	24
Cagayan	30	2	32	17	6
Capiz	13	8	21	17	7
Cavite	0	0	0	0	20
Cebu	8	1	9	7	42
Ilocos Norte	16	0	16	14	15
Ilocos Sur	20	0	20	17	23
Iloilo	10	0	10	5	22
Isabela	15	0	15	11	15
Laguna	11	1	12	10	17
La Union	10	0	10	10	4
Leyte	19	10	29	16	29
Mindoro	0	2	2	1	16
Misamis	14	1	15	11	42
Mindanao and Sulu:					
Agusan	1	0	1	1	56
Bukidnon	1	0	1	1	12
Cotabato	0	0	0	0	30
Davao	0	0	0	0	15
Lanao	2	0	2	2	36
Sulu	0	0	0	0	24
Zamboanga	3	0	3	2	8
Mountain Province:					
Amburayan	6	0	6	5	4
Apayao	0	0	0	0	5
Benguet	1	0	1	1	12
Bontoc	0	0	0	0	7
Ifugao	0	0	0	0	3
Kalinga	0	0	0	0	4
Lepanto	1	1	2	1	10
Occidental Negros	25	3	28	14	10
Oriental Negros	14	1	15	13	33
Nueva Ecija	16	5	21	18	35
Nueva Vizcaya	1	0	1	1	7
Palawan	0	0	0	0	14
Pampanga	3	0	3	3	18
Pangasinan	30	0	30	23	42
Rizal	4	0	4	3	22
Romblon	6	0	6	4	3
Samar	38	5	43	31	9
Sorsogon-Masbate	13	1	14	10	14
Surigao	11	2	13	7	2
Tarlac	7	2	9	7	9
Tayabas	45	1	46	23	8
Zambales	14	0	14	12	2
Total	501	63	564	405	672

Provinces.	Parcels.	Hectares.
Bulacan	1	232
Cagayan	1	325
Ilocos Norte	4	1,177
Misamis	1	400
Negros Occidental	3	520
Tayabas	1	126
Total	11	2,780
Total number of parcels and hectares established from 1908 to 1918	581	100,120
Total number of parcels and hectares cancelled in various years	11	2,780
Balance in force	570	97,340

MAPPING AND DRAFTING SECTION.

There has been prepared a new map of Luzon, Mindoro and adjacent Islands, on a scale of 1:400,000, containing all the latest valuable data secured from the Bureaus of Coast and Geodetic Surveys, Lands, Public Works, Constabulary, and other sources, to which there have been added the topographical and forest data secured by the field personnel of this Bureau. This map is for administrative use only.

The following table shows the work carried out during 1918:

Topographical and forest notes taken during 1918.

District No.	Received.	Pending.	Total.	Forest value.
	Kilometers.	*Kilometers.*	*Kilometers.*	*Hectares.*
1	147.91	852.74	1,000.65	.50
2	100.38	68.07	168.45	----------
3	14.21	----------	14.21	----------
4	196.55	143.41	339.96	93.58
5	323.07	831.24	1,154.31	228.60
6	369.14	300.67	669.81	160.14
7	477.41	120.29	597.70	1.95
8	556.85	247.36	804.21	45.36
9	250.20	162.25	412.45	9.50
10	437.90	369.27	807.17	18.20
11	99.87	198.36	298.23	183.16
12	123.24	100.37	223.61	7.00
13	14.06	457.98	472.04	13.00
Total	3,110.79	3,852.01	6,962.80	760.99

Considerable graphical information has been added to the forest progressive sheets on the scales of 1:100,000 and 1:20,000. In addition, there have been traced different original plans for communal forests, maps of private lands for registration, model houses for forest stations, auxiliary schooners, and various other drafting work. The bars for the twelve sets of pantographs made by the Bureau have also been graduated. One thousand eight hundred and twenty (1,820) copies of blue prints were prepared for the public in general and for official purposes.

SECTION OF FOREST RECONNAISSANCES.

In view of the fact that 60 per cent of the personnel of this section specially trained in forest reconnaissance work have entered the Philippine Guard as officers, part of the projects planned during the year was necessarily suspended. The rangers of this section entering the Philippine Guard were all assigned as instructors in military mapping and sketching, which speaks well for their training and work in the Bureau. However, the reports on the reconnaissances made at the end of last year have been finished, and during this year five reconnaissances have been completed.

1. Mineral region of Paracale and Mambulao, Ambos Camarines, October, 1917.
2. Central region of Tayabas Province, October, 1917 to February, 1918.
3. Region between Lauis (north) and Salasa (south) rivers, Masinloc, Zambales, April and May, 1918.
4. Northern region of Ragay Gulf, Ragay, Ambos Camarines, April and May, 1918.
5. Coal region in Sibuguey, Zamboanga, Zamboanga, December, 1917 to June, 1918.
6. Kabibihan region (Filipinas Lumber Co.), Guinayangan, Tayabas, March and earlier part of April, 1918.

1. *Mineral Region of Paracale and Mambulao, Ambos Camarines.*—In this reconnaissance, the attempt was made to locate every mineral claim in the jurisdiction of Paracale and Mambulao, for the purpose of studying the necessities of each one with respect to wood consumption and to better the handling of forest products found therein, but due to the defective methods of the original laying-out of the claims, not all that was desired could be accomplished. The majority of them, however, were located. There were 40 placer claims and 302 lode claims and Spanish concessions, scattered over an approximate area of 17,990 hectares. Among the companies in active operations on the gold claims are the following:

Malaguit Dredging Company.
Paracale Bucket Dredging, Ltd.
Philippine Dredgers, Ltd.
Malagno Placer Co.
Gumaos Placer Co.
Le Duc Mine.
Mambulao Placer Co.

Aside from the above, there were also several other prospected claims which, according to indications, will start operations within a short time. In and about Mambulao iron deposits were also located and immediate development is said to be under serious consideration by the locators.

Almost all of the above-mentioned companies are operating placer claims and a careful study of the conditions with regard to meeting the wood consumption of the dredges was the main object of the reconnaissance. The question of supplying adequate amounts of timber for building and firewood purposes has been the serious problem of some of the miners who were not fortunate enough to have an abundant supply of timber on their claims for development. These miners have to resort to the supply of firewood for fuel. The small amount of coal available during the year ran to such prices that it was almost prohibitive to use coal and for this reason the miners had to depend entirely upon the supply of firewood to keep the dredges running. For this purpose, licenses were issued to allow them to operate on unoccupied areas. The data gathered enable this Office to decide questions raised by the needy miners and to regulate the operations of the licensees.

2. *Central Region of Tayabas.*—Due to the opening up of the southern extension of the Manila Railroad Company, followed by rapid agricultural and commercial development, the necessity for a more thorough knowledge of the country was indispensable. To meet the numerous inquiries of the public with regard to possible cutting operations and vacant agricultural land, the Bureau of Forestry made a reconnaissance of the central region of Tayabas Province, comprising the municipalities of Unisan, Pitogo, Macalelon, and Mulanay, on the southern coast, and Gumaca, Lopez, Calauag, and part of Guinayangan, on the Pacific coast. This reconnaissance was made mainly to secure information regarding topography and forest condition of this region for better administration and for the proposed establishment of forest and agricultural zones. The report covering this area is divided into two main headings; that is, the study of the highland forest and of the mangrove swamps.

Extension of Area of the Highland Forest.—The area considered as highland forest in this region is approximately 36,090 hectares in extent, located in four separate blocks. These four blocks of forest are further divided into ten compartments, each compartment having its corresponding field data which are sufficient to appraise the importance and value of any of the particular sections.

Extension and Area of Mangrove Swamps.—The lowland or mangrove swamps discussed comprise an area of 8,090 hectares and have likewise been studied. The information acquired regarding their forest value is of material help to this Office. These swamps are also located in four separate blocks, and are divided into fifteen compartments.

3. *Region Between Lauis (north) and Salasa (south) Rivers, Masinloc, Zambales.*—A detailed study of the region between Lauis (north) and Salasa (south) rivers of Masinloc, Zambales, was made during the year 1918. The study was mainly to secure as much information as possible regarding the topography and stand of timber for more extensive management and forest utilization. The proximity of this region to the timber markets,

coupled with a good stand of timber, attracted the attention of lumbermen for the information of whom the report was made. The report submitted covering this region was grouped into two parts; the first deals with the general description of the area, while the second deals with the logging, manufacturing and shipping facilities. A company that is holding an ordinary timber license in this region is contemplating taking up a long term concession for the proper development of the timber industry in this region. The area covered by this sutdy is approximately 16 kilometers from east to west and 7 to 14 kilometers from north to south.

4. *Northern Region of Ragay Gulf, Ragay, Ambos Camarines.*—The territory covered by the reconnaissance made in the northern region of Ragay Gulf is located between Ragay and the Tagcauayan-Labo trail in the Municipality of Ragay, Ambos Camarines. It comprises an area of approximately 70,800 hectares divided as follows:

Commercial forest	hectares	62,360
Cogon	do	4,460
Brush	do	2,060
Cultivated	do	1,920
Total	do	70,800

The main object of the reconnaissance was to secure as much information as possible regarding the condition of the country for better management. In this region there are small sawmills operating under ordinary timber licenses, and in order to manage their operations intelligently, more comprehensive data of the actual conditions were essential.

5. *Coal Region in Sibugüey, Zamboanga.*—A forest reconnaissance was made on the Sibuguey Peninsula for the purpose of studying the timber stand for better management in connection with the operations of the National Coal Company. The territory covered by this study is bounded on the north, by the parallel of latitude 7° 42′; east, by Dumanquilas Bay; south, by Locsico and Tantanang Bays, Canalizo Strait, north of Olutanga Island; and on the west, by Sibuguey Bay. The extent of the area from north to south is approximately 22 kilometers and from east to west 26 kilometers. The coast-lines extend approximately 65 kilometers, mostly on the western and southern sides.

The area is estimated to be 45,600 hectares or 456 square kilometers. An approximate area of 16,200 hectares or 16.2 square kilometers is covered with commercial forest; 25,200 hectares or 25.2 square kilometers, with non-commercial forest in which brush land, grass land, marshes, and small cultivated portions are included; 4,200 hectares or 4.2 square kilometers, with mangrove and nipa swamps, occupying an area along the western coast. The greater part of this peninsula is uninhabited and not often visited by natives.

The hills of Sibuguey and Bailan rise abruptly from the western coast and form several broken chains of hills ranging from 700 to 1,000 feet in elevation, and descending to the Lutima Valley. These hills from the principal central divide between the north and the south parts of the peninsula. With the exception of the few precipitous slopes in the Sibuguey and Kaladis Mountains, the hills rise gradually, few of them attaining an altitude of over 1,000 feet.

6. *Kabibihan Region, Guinayangan, Tayabas.*—In connection with the summer camping trip of the students of the Forest School at Los Baños, Laguna, a reconnaissance party from the main office was assigned with the end in view of locating the agricultural and forest lands, to secure as much information as possible for a better exploitation of the forest and at the same time to prepare the basis for the establishment of forest zones and reserves. The timber stand covered by the reconnaissance contains approximately 2,000,000 cubic meters, which is enough to furnish the mill (Filipinas Lumber Co.) operating in the locality for a period of forty years. The timber consists largely of Yakal, Apitong, Guijo, and similar species, all of which are at present in demand in the markets.

The area consists of a comparatively narrow strip along the coast which is level, a much larger area back of this which is rolling and an area in the upper part of the concession which is rough. All of the area is capable of being logged by steam, except some of the flat land along the coast, which is culled over and where the timber is too scattered to warrant the use of steam logging machinery.

Taken as a whole, the area studied, that is, the region within the concession of the Filipinas Lumber Company, presents a very favorable opportunity for steam logging, and with the opening of the railroad through this region offers better prospects for the company.

ADMINISTRATIVE DIVISION.

The work of this division, having charge of all the clerks, was somewhat handicapped during the year because of the fact that many clerks have passed Civil Service examinations for higher rating, while the Bureau had no funds appropriated to pay the salaries called for under their new Civil Service grade. As a result, several clerks resigned or sought transfers to other bureaus of the Government having positions vacant in the new grades. This resulted in the Bureau being exceedingly short-handed as far as clerks were concerned. Another factor from which the Bureau suffered was the inability to obtain eligibles from the Bureau of Civil Service for positions vacated by clerks having obtained higher Civil Service rating. At the present time these positions are vacant and the work is being carried on by the remaining clerks, which, at best, is not satisfactory. Furthermore, the increase in the number of clerks has not been in proportion to the work necessitated by the increase in field personnel and the resulting activities. To keep the work up as in the past, it will be necessary to increase the number of clerks and to allow certain elasticity in the appropriation to take care of clerks who have obtained higher Civil Service ratings.

GENERAL SERVICE SECTION.

The system of handling correspondence, which was instituted and studied last year, has been found very efficient, relieving to some extent the pressure of work on certain clerks and not interfering with the routing of correspondence and work of the several division chiefs. It allowed the saving of time for messengers who were put on quasi-clerical work to help out the situation.

RECORDS SECTION.

It has become increasingly difficult to hold an efficient record clerk because of the salary allowed. The chief of this section, who took over the position upon the resignation of the former chief in 1917, resigned because of better opportunities in private work. A new chief was appointed from another Bureau. Because of the frequent change of personnel in this section, since the present filing scheme requires intimate acquaintance with the subject matter of the correspondence, which is identified in this Bureau by the subject dealt with, under special designation, it is found necessary to introduce a system whereby the filing and recording of correspondence will be made less dependent upon the changing personnel, and it is planned to institute a decimal system for trial this coming year.

ACCOUNTING SECTION.

The accounting system as inaugurated by the Bureau of Audits in the past year has been followed, which has simplified the work to some extent. The personnel of this section has been augmented in view of the fact that the necessary journals, ledgers, and other records of account which were formerly taken care of by the Bureau of Audits have been placed in the Bureaus charged. It is believed that with the increase in personnel of this section, the requests for the prompt payment of traveling expenses, etc., will be satisfied, with as little delay as possible.

PROPERTY SECTION.

During the past year, at times, certain stocks carried in the Bureau ran very low, due principally to the impossibility of obtaining material and equipment from the United States. The entire personnel of the Bureau was again cautioned as to the necessity for the greatest economy in the use of expendable and nonexpendable property. As stated before, practically all the equipment, such as tables, record files, etc., were made in the Bureau's workshop.

STATISTICS SECTION.

The work on statistics of forest products has been carried on fairly well despite the handicap of a lack of sufficient personnel, and it is hoped that as soon as this section is fully staffed, a system of devising methods for securing more accurate and complete data will be put into practice.

LIBRARY AND TRANSLATING SECTION.

New books, catalogs, trade journals, and scientific papers were properly filed and listed upon receipt. All items of interest to the Bureau were clipped from the newspapers of the Islands. All journals and scientific papers of permanent value were bound, and the lumber journals of 1917 were sent out to the field force. The matter of supplying the field force with readable literature is being studied, as many of the outlying stations have not the advantage of using books from the school libraries. Several sets of journals and novels were furnished the Forest School, through this section, from the Philippine Library.

PROPOSED CHANGES.

Due to the increase in personnel in the field force of the Bureau, it is thought necessary that another division, which will have under its jurisdiction the finances and accounts of the Bureau, be created at the beginning of next year. This division will relieve the Chief Clerk to a great extent and will allow him time to concentrate his activities on the execution of the administrative work of the Bureau. The new chief of this division will be authorized to sign for the Director on routine matters concerning finances, accounts and property, which will, to a great extent, relieve the Director of this work.

CLASSIFICATION OF WORK.

As will be noticed in this year's report, a more detailed classification has been instituted in figuring the cost of the various classes of major work in the Bureau. The per cent of cost has been decreased to quite an extent in certain lines and increased considerably in others. For instance, the reconnaissance has been increased over last year. It then included the forest zone work, which under this year's classification is separated, showing an increase in what is essentially forest work. Forest zones were separated this year, inasmuch as the cost data on the future forest reserves will be compiled in such a manner that the Bureau will be in a position to give the exact cost of all work on each individual reserve when proclaimed. Land cases and private woodlands have been separated from the general classification "public lands" so as to get a more detailed idea of the time and money spent on this special work, which is becoming increasingly important. The classification "concessions" has been separated from the classification "licenses" for the same reason, and it is hoped that in the future, as work of a distinct nature becomes of sufficient importance, that data as to cost and time spent will be compiled.

Table showing number of days and cost of each class of work performed by the field force of the Divisions of Forest Management and Forest Lands and Maps during the fiscal year, 1918.

District.	Licenses.				Caiñgins.				Public lands.			
	Days.		Cost.		Days.		Cost.		Days.		Cost.	
	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.
No. 1	1,571	37.64	3,731.12	31.66	30	.77	64.09	.55	827	20.48	2,395.37	20.70
No. 2	406	32.25	1,454.78	30.20	33	2.68	101.71	2.06	386	30.64	1,580.26	32.71
No. 3	1,772	58.52	2,489.73	37.65	99	3.36	121.50	1.84	30	.99	106.00	1.60
No. 4	575	27.40	1,726.48	24.85	13	.62	50.61	.74	792	37.70	2,743.46	39.84
No. 5	1,889	29.40	4,447.01	21.88	348	5.40	741.52	3.67	1,307	20.30	3,808.08	18.81
No. 6	1,523	33.40	3,486.57	26.33	697	15.27	1,685.08	12.18	725	15.88	2,440.94	18.23
No. 7	2,201	29.79	5,197.28	29.56	789	10.61	1,468.72	8.39	892	12.01	2,588.52	14.78
No. 8	1,926	23.54	5,144.23	16.59	261	3.17	611.30	1.99	1,216	14.85	6,193.01	19.99
No. 9	436	75.39	1,373.97	34.47	130	10.70	507.85	12.74	322	26.00	1,069.81	26.88
No. 10	1,162	37.36	3,318.84	35.00	308	9.75	1,030.58	10.85	634	20.53	2,194.51	23.10
No. 11	2,227	37.80	4,536.24	31.40	167	2.82	404.89	2.79	379	6.43	1,113.82	7.78
No. 12	293	23.55	981.24	23.02	66	5.39	132.14	3.10	420	33.62	1,526.07	35.18
No. 13	585	25.00	1,664.52	17.75	217	9.30	600.43	6.44	351	14.94	1,113.57	11.92
Total	16,566	32.80	39,551.69	25.71	3,158	6.20	7,519.87	4.90	8,281	16.40	28,867.42	18.80

Table showing number of days and cost of each class of work performed by the field force of the Divisions of Forest Management and Forest Lands and Maps during the fiscal year, 1918—Continued.

District.	Communal forest.				Forest zones.				Reconnaissance.			
	Days.		Cost.		Days.		Cost.		Days.		Cost.	
	Number.	Per-cent.	Number.	Per-cent.	Number.	Per-cent.	Number.	Per-cent.	Number.	Per-cent.	Number.	Per-cent.
No. 1	67	1.70	236.56	2.03					498	12.60	1,314.68	11.27
No. 2	49	3.90	149.80	3.07								
No. 3	1	.03	12.51	.19					11	.36	130.64	1.98
No. 4	73	3.48	223.50	3.23	13	.62	56.21	.82	102	4.86	402.84	5.85
No. 5	39	.66	119.47	.60	108	1.67	336.07	1.54	289	4.49	1,153.62	5.71
No. 6	72	1.68	243.12	1.82	5	.11	13.34	.01	234	5.12	1,255.58	9.50
No. 7	68	.91	219.36	1.28					54	.72	238.90	1.39
No. 8	52	.63	184.14	.59					518	6.34	3,389.79	10.98
No. 9												
No. 10	129	4.17	419.22	4.40	4	.13	12.75	.13	4	.13	8.75	.09
No. 11	83	1.41	209.70	1.45	91	4.54	441.43	3.03	168	2.85	582.82	4.08
No. 12	17	1.38	62.54	1.47	19	1.55	59.32	1.38				
No. 13	127	5.43	379.41	4.07					134	5.74	577.80	6.19
Total	777	1.50	2,459.33	1.60	240	.45	919.12	.60	2,012	3.90	9,054.87	5.88

District.	Land cases.				Private woodlands.				Concession.			
	Days.		Cost.		Days.		Cost.		Days.		Cost.	
	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.
No. 1	17	.44	40.99	.85								
No. 2	11	.90	75.80	1.57	2	.16	5.33	.11				
No. 3									88	2.92	85.48	1.29
No. 4	99	4.72	366.32	5.39	8	.39	30.64	.45	11	.59	53.78	.78
No. 5	123	1.91	599.45	2.97	63	.98	225.44	1.15	217	3.38	550.79	2.76
No. 6	39	.85	163.28	1.23	30	.65	104.75	.79	20	.43	55.51	.05
No. 7	125	1.66	517.45	2.94	82	1.10	163.09	.98	2,407	32.50	3,662.55	20.47
No. 8	39	.47	171.82	.56	3	.08	11.51	.04	2,609	31.98	10,362.14	38.42
No. 9	19	1.54	50.62	1.27	1	.08	4.16	.12				
No. 10	8	.26	64.11	.67								
No. 11	99	1.67	433.15	2.98	42	.71	127.74	.88	961	16.35	1,785.48	12.39
No. 12	6	.49	42.02	.97	3	.24	9.42	.24				
No. 13	60	2.56	265.80	2.83	5	.21	48.82	.52	3	.12	64.55	.69
Total	645	1.22	2,790.81	1.81	239	.45	730.90	.48	6,316	12.40	16,620.28	10.81

District.	Nurseries.				Patrol trail and trail building.				Botanical collections.			
	Days.		Cost.		Days.		Cost.		Days.		Cost.	
	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.
No. 1	49	1.28	187.28	1.60					11	.29	22.31	.19
No. 2	132	10.44	554.06	11.46					4	.32	17.84	.37
No. 3	65	2.15	314.93	4.76	44	1.52	31.50	.48	17	.56	11.64	.18
No. 4	2	.09	5.83	.08					8	.39	23.47	.35
No. 5	4	.06	854.00	4.22	409	6.35	999.79	4.93	34	.52	99.54	.51
No. 6	1	.02	2.10	1.59					42	.92	90.66	.07
No. 7	41	.55	151.50	.87					8	.01	19.24	.02
No. 8	5	.06	18.92	.06	186	2.27	201.37	.65	48	.58	120.15	.42
No. 9	8	.65	43.48	1.09					26	2.14	108.49	2.78
No. 10	4	.18	11.17	.11					13	.42	37.61	.39
No. 11	32	.55	83.30	.57	219	3.72	907.72	6.30	79	1.38	188.92	1.30
No. 12									2	.16	11.38	.27
No. 13	275	1.72	2,319.81	24.63	162	6.98	551.82	5.89	7	.28	15.56	.19
Total	618	1.20	4,546.38	2.95	1,020	2.01	2,692.20	1.75	299	.54	775.81	.55

Table showing number of days and cost of each class of work performed by the field force of the Divisions of Forest Management and Forest Lands and Maps during the fiscal year, 1918—Continued.

District.	Sundays and holidays.				Travel.				Leave.			
	Days.		Cost.		Days.		Cost.		Days.		Cost.	
	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.
No. 1	424	10.68	1,642.30	14.09	105	2.66	653.31	5.60	77	1.95	181.19	1.56
No. 2	150	11.92	456.07	9.45	15	1.15	144.84	2.98	43	3.42	157.39	3.26
No. 3	411	13.60	846.70	12.81	14	.47	104.79	1.58	58	1.92	158.85	2.27
No. 4	247	11.60	608.00	8.85	22	1.05	174.87	2.59	75	.57	196.63	2.85
No. 5	809	12.52	2,133.18	10.51	83	1.29	525.40	2.60	296	4.60	726.99	3.60
No. 6	584	12.80	1,272.27	9.65	108	2.36	863.54	6.52	168	3.68	421.39	3.18
No. 7	238	3.21	1,585.75	8.80	50	.67	387.04	2.20	98	1.34	237.07	1.38
No. 8	929	11.35	3,331.87	10.75	99	1.21	606.07	1.96	112	1.37	328.23	1.05
No. 9	147	11.65	356.18	8.95	29	2.35	177.88	4.45	43	3.39	99.71	2.52
No. 10	437	14.60	1,091.95	11.47	50	1.67	394.66	4.14	172	5.56	429.91	4.44
No. 11	591	10.40	1,245.00	8.55	103	1.75	649.85	4.51	434	7.35	935.40	6.49
No. 12	192	15.66	571.45	13.40	55	4.48	331.17	7.76	39	2.85	109.62	2.55
No. 13	248	10.60	641.04	6.86	23	.98	330.92	3.62	90	3.84	216.17	2.33
Total	5,407	10.60	15,731.76	10.21	756	1.43	5,344.34	3.47	1,705	3.50	4,193.55	2.72

District.	Miscellaneous.				Total.			
	Days.		Cost.		Days.		Cost.	
	Number.	Per-cent.	Number.	Per-cent.	Number.	Per-cent.	Number.	Per-cent.
No. 1	372	9.51	1,208.85	10.39	4,048	7.95	11,677.50	7.58
No. 2	28	2.22	182.78	2.76	1,259	2.70	4,830.61	3.39
No. 3	412	13.59	2,204.58	33.37	3,022	5.90	6,613.80	4.30
No. 4	62	2.93	224.71	3.33	2,102	4.13	6,887.85	4.47
No. 5	416	6.46	2,991.98	14.54	6,434	12.62	20,307.28	13.20
No. 6	317	6.93	1,171.25	8.85	4,565	8.96	13,269.88	8.63
No. 7	365	4.92	1,229.34	6.99	7,418	14.59	17,615.81	11.48
No. 8	174	2.15	289.64	.95	8,177	16.08	30,978.19	20.01
No. 9	73	5.91	193.41	4.88	1,234	2.42	3,984.56	2.58
No. 10	178	5.59	495.05	5.21	3,098	6.05	9,509.06	6.24
No. 11	214	3.63	808.64	5.50	5,889	11.58	14,453.10	9.39
No. 12	136	10.68	425.16	10.05	1,248	2.45	4,261.53	2.65
No. 13	54	2.32	568.88	6.07	2,341	4.60	9,358.60	6.08
Total	2,796	5.40	11,943.17	7.76	50,835	100	153,741.77	100

COÖPERATION.

The policy of coöperating with other government agencies and private enterprises to the fullest extent and with every means available has been continued. This has been touched upon under other headings in this report.

INCOME.

The income of the Bureau, as will be noticed from the table in the appendix during the past year, amounts, from the latest figures available, to ₱650,691.61, while the appropriation of the Bureau last year, including the deficiency, amounted to ₱352,100, of which ₱332,334.72 were spent, giving a percentage of expenditures to revenues of 51.

RECOMMENDATIONS.

The undersigned wishes to again repeat the recommendations made in last year's annual report.

The illegal occupation of public land to be punished by law.

The penalties for the destruction of forests to be increased.

The penalties for evading the payment of forest charges should be materially increased for the second offense.

The illegal cutting of forest products should be classed as theft and treated as such.

Section 1520 of the Administrative Code should be changed to require the payment of forest charges on all forest products cut or gathered, whether removed from the forest or not, before a license expires.

Efficient means for the eradication of water hyacinth should be instituted.

Forest guards should be forbidden to have any pecuniary interest in forest products.

The Bureau of Forestry should be given positions for qualified surveyors to do the urgent survey work on forest reserves. Coöperation with the Bureau of Lands as recommended under the Division of Forest Lands and Maps should be instituted. An attorney of the Bureau of Justice should be assigned wholly to the legal work of this Bureau. Provincial fiscals to take more interest in forestry cases, especially in the presentation of evidence.

It is recommended that the present system of the disposal of public lands be changed, inasmuch as at present lands are selected by individuals, settled and cultivated to some extent, before surveys have been made, and it is next to impossible to guard the interests of the Government along conservation lines as long as this system is followed. Conflicts are constantly being engendered between neighboring settlers as well as with the Government. No provision is made for possible rights-of-way by the Government for roads, etc., in new areas and it is a well-known fact, brought out by several investigations throughout the world, that the individual in general is not competent to select land for his own best interest or that of the Government. It is recommended that the Government institute as soon as possible a system of surveying land before settlement, as is now being done in some of the agricultural colonies.

Provision should be made for a permanent forest guard force. An increase in the clerical personnel, not only in number but also in salaries, is essential. Provision should be made for a systematic reforestation and reconnaissance on a large scale.

For the Forest School and the Division of Investigation additional buildings are necessary as well as additional equipment to adequately give the higher course and carry on ivestigative work. Additional cottages are necessary for the housing of the students and personnel of the School and the Division of Investigation.

Personnel.—As stated last year, the demand for forest officers of the Bureau of Forestry in the Orient has again been felt, and is strongly recommended, that the salaries be placed on the same basis as all other scientific branches of the Government; that the amount of per diems now received by the rangers be increased, necessitating a change in the Administrative Code; that field clothing, especially shoes, blankets, mosquito nets and khaki, be bought by the Bureau and sold to the men in the field at cost.

It is further recommended, that game and fish legislation to be made stricter and entrusted to forest officers for administration.

Arthur F. Fischer

Director of Forestry.

The SECRETARY OF
AGRICULTURE AND NATURAL RESOURCES,
Manila.

APPENDIX.

STATISTICAL TABLES.

TABLE NO. 1.—*Statement of the public lands applications received from the Bureau of Lands and of the certifications made to the same regarding the agricultural or forest value.*

Provinces.	Received from the Bureau of Lands.									Certification made to the Bureau of Lands.								
	Pending from previous year.				During the year 1918.				Total.	Agriculture.				Forestry.				Total.
	A. C.	H.	P.	L.	A. C.	H.	P.	L.		A. C.	H.	P.	L.	A. C.	H.	P.	L.	
Abra	0	8	1	0	0	21	1	0	31	0	23	0	0	0	0	0	0	23
Agusan	0	99	4	0	0	164	19	8	294	0	162	9	3	0	0	5	2	181
Albay	0	18	6	0	0	169	9	0	202	0	113	7	0	0	10	0	0	130
Ambos Camarines	0	304	4	0	0	359	18	3	683	0	307	1	0	0	100	2	1	411
Antique	0	13	0	0	0	28	0	0	41	0	22	0	0	0	0	0	0	22
Bataan	0	42	6	1	0	159	20	3	231	0	103	14	1	0	2	0	1	121
Batanes	0	0	0	0	0	5	1	0	6	0	5	1	0	0	0	0	0	6
Batangas	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0
Bohol	0	12	1	0	0	40	1	4	58	0	37	1	3	0	0	0	0	41
Bukidnon	0	0	0	0	0	12	1	1	14	0	5	0	0	0	0	0	0	5
Bulacan	0	24	2	0	0	7	0	0	33	0	20	2	0	0	5	0	0	27
Cagayan	0	84	7	0	0	253	13	1	358	0	235	13	0	0	1	0	0	249
Capiz	0	25	3	1	0	27	2	0	58	0	8	2	0	0	9	0	0	19
Cavite	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cebu	0	6	2	0	0	17	8	0	33	0	11	7	0	0	1	0	0	19
Cotabato	0	63	10	6	41	394	2	9	525	41	214	10	3	0	0	0	0	268
Davao	0	198	15	22	0	370	44	103	752	0	284	25	35	0	9	0	1	354
Ilocos Norte	0	10	2	0	0	15	1	1	29	0	9	2	0	0	3	0	1	15
Ilocos Sur	0	69	12	0	0	147	13	1	242	0	136	18	0	0	10	0	0	164
Iloilo	0	3	1	0	0	18	4	0	26	0	6	3	0	0	0	0	0	9
Isabela	0	94	0	1	0	135	8	2	240	0	181	7	8	0	2	0	0	198
Laguna	0	7	0	0	0	44	3	0	54	0	14	0	0	0	9	3	0	26
Lanao	0	23	1	0	0	71	1	1	97	0	63	1	0	0	1	0	0	65
La Union	0	64	7	1	0	58	7	3	135	0	90	9	1	0	7	1	1	109
Leyte	0	141	6	0	0	212	12	3	374	0	171	9	1	0	14	0	0	196
Mindoro	0	250	14	0	0	409	35	9	717	0	335	28	6	0	53	1	0	423
Misamis	0	9	1	0	0	41	1	0	52	0	42	1	0	0	4	1	0	48
Mountain	0	48	6	1	0	24	1	1	81	0	33	2	1	0	8	2	1	47
Negros Occidental	0	120	1	0	0	325	10	5	461	0	262	6	0	0	48	1	1	318
Negros Oriental	0	6	1	0	0	8	1	0	16	0	0	0	0	0	2	0	0	2
Nueva Ecija	0	621	40	5	0	1,432	97	50	2,245	0	1,232	81	31	0	127	9	3	1,483
Nueva Vizcaya	0	74	17	0	0	173	6	2	272	0	133	17	0	0	0	0	0	150
Palawan	0	102	1	1	0	112	2	3	221	0	89	2	8	0	9	0	0	108

Pampanga	0	12	0	0	0	36	4	1	53	0	22	2	1	0	9	0	0	34
Pangasinan	0	258	19	1	0	248	56	6	588	0	300	58	4	0	21	2	2	382
Rizal	0	8	1	0	0	40	5	1	55	0	81	4	1	0	8	0	0	89
Romblon	0	0	0	0	0	4	0	0	4	0	0	0	0	0	0	0	0	0
Samar	0	9	0	0	0	82	2	0	48	0	30	0	0	0	1	0	0	31
Sorsogon	0	44	9	0	0	162	10	2	227	0	110	6	1	0	10	1	0	128
Sulu	0	0	0	0	0	1	0	0	1	0	1	0	0	0	0	0	0	1
Surigao	0	2	0	0	0	29	4	1	36	0	20	8	1	0	2	0	0	26
Tarlac	0	35	7	1	0	214	21	5	288	0	82	6	4	0	2	0	0	44
Tayabas	0	367	39	0	0	727	47	1	1,172	0	818	23	0	0	115	8	0	454
Zambales	0	143	21	11	0	41	9	9	234	0	105	19	5	0	5	2	1	187
Zamboanga	0	75	7	1	0	370	31	6	490	0	296	26	1	0	19	0	1	348
Total	0	3,485	265	58	41	7,148	526	245	11,763	41	5,605	420	109	0	621	33	16	6,845

TABLE No. 1.—*Statement of the public lands applications received from the Bureau of Lands and of the certifications made to the same regarding the agricultural or forest value*—Continued.

Provinces.	Returned to the Bureau of Lands uncertified during the year 1918.				Total pending inspection December 31, 1918.				
	H.	P.	L.	Total.	A. C.	H.	P.	L.	Total.
Abra	0	0	0	0	0	6	2	0	8
Agusan	7	0	0	7	0	94	9	3	106
Albay	0	1	0	1	0	64	7	0	71
Ambos Camarines	3	0	0	3	0	253	14	2	269
Antique	0	0	0	0	0	19	0	0	19
Bataan	3	1	2	6	0	93	11	0	104
Batanes	0	0	0	0	0	0	0	0	0
Batangas	0	0	0	0	0	0	1	0	1
Bohol	2	0	0	2	0	13	1	1	15
Bukidnon	0	0	0	0	0	7	1	1	9
Bulacan	3	0	0	3	0	3	0	0	3
Cagayan	15	1	0	16	0	86	6	1	93
Capiz	2	1	0	3	0	33	2	1	36
Cavite	0	0	0	0	0	0	0	0	0
Cebu	0	0	0	0	0	11	3	0	14
Cotabato	0	0	2	2	0	243	2	10	255
Davao	7	0	7	14	0	268	34	82	384
Ilocos Norte	2	1	0	3	0	11	0	0	11
Ilocos Sur	9	0	0	9	0	61	7	1	69
Iloilo	0	0	0	0	0	15	2	0	17
Isabela	3	0	0	3	0	43	1	0	44
Laguna	1	0	0	1	0	27	0	0	27
Lanao	1	0	0	1	0	29	1	1	31
La Union	1	0	0	1	0	19	4	2	25
Leyte	24	1	1	26	0	144	8	1	153
Mindoro	6	1	0	7	0	265	19	3	287
Misamis	1	0	0	1	0	3	0	0	3
Mountain	4	0	0	4	0	27	3	0	30
Negros Occidental	18	0	1	19	0	117	4	3	124
Negros Oriental	0	0	0	0	0	12	2	0	14
Nueva Ecija	71	1	1	73	0	623	46	20	689
Nueva Vizcaya	8	0	0	8	0	111	6	2	119
Palawan	3	0	0	3	0	113	1	1	115
Pampanga	8	0	0	8	0	14	2	0	16
Pangasinan	4	1	0	5	0	176	19	1	196
Rizal	0	0	0	0	0	14	2	0	16
Romblon	0	0	0	0	0	4	0	0	4

Samar	0	0	0	0	0	10	2	0	12
Sorsogon	1	0	1	2	0	85	12	0	97
Sulu	0	0	0	0	0	0	0	0	0
Surigao	0	0	0	0	0	9	1	0	10
Tarlac	0	1	0	1	0	215	21	2	238
Tayabas	18	1	0	14	0	653	50	1	704
Zambales	0	0	0	0	0	74	9	14	97
Zamboanga	5	0	1	6	0	125	12	4	141
Total	215	11	16	242	0	4,192	327	157	4,676

Fiscal year—	Agricultural colonies.			Homesteads.			Sale applications.			Leases.			Grand total.
	Agriculture.	Forest.	Total.	Agriculture.	Forest.	Total.	Agriculture.	Forest.	Total.	Agriculture.	Forest.	Total.	
1905	0	0	0	80	6	86	8	0	8	0	0	0	94
1906	0	0	0	318	16	344	20	1	21	1	0	1	356
1907	0	0	0	881	19	900	23	0	23	12	0	12	935
1908	0	0	0	2,456	51	2,507	49	1	50	26	0	26	2,583
1909	0	0	0	1,523	187	1,710	26	3	29	27	0	27	1,766
1910	0	0	0	1,175	385	1,560	34	5	39	42	2	44	1,643
1911	0	0	0	1,528	221	1,749	46	3	49	80	1	31	1,829
1912	0	0	0	2,609	301	2,910	95	11	106	47	1	48	3,064
1913	0	0	0	2,680	269	2,949	104	30	134	47	1	48	3,131
1913 (July 1 to December 31)	0	0	0	1,653	159	1,812	81	16	97	41	3	44	1,953
1914	0	0	0	4,812	685	5,497	279	36	315	77	1	78	5,890
1915	1,086	28	1,114	5,965	688	6,653	317	52	369	70	1	71	8,207
1916	934	41	975	6,015	670	6,685	227	18	245	55	4	59	7,964
1917	670	0	670	7,632	797	8,429	457	27	484	118	6	124	9,707
1918	41	0	41	5,605	621	6,226	420	33	453	109	16	125	6,845
Total	2,731	69	2,800	44,932	5,075	50,007	2,186	236	2,422	702	36	738	55,967

SUMMARY.

Applications on hand during 1918		11,768
Certified for Agriculture	6,175	
Certified for Forestry	670	
Returned uncertified	242	
		7,087
Total pending December 31, 1918		4,676

Furthermore, at the request of the applicants 689 parcels of public land have been inspected, the certificate of which is now pending the request by the Bureau of Lands.

NOTE.—A. C.=Agricultural Colony of 16 hectares lot; H.=Homestead; P.=Purchase; L.=Lease.

TABLE NO. 2.—*Statement showing amounts in cubic meters of important timbers, by species, cut and invoiced in the Philippine Islands during fiscal year 1910 to 1918.*

Species.	Fiscal year—				July 1 to Dec. 31, 1913.	Fiscal year.					Total, 1910 to 1918.
	1910	1911	1912	1913		1914	1915	1916	1917	1918	
Lauan	43,439	46,942	57,086	81,469	20,249	74,453	73,277	107,634	131,699	108,900	745,098
Apitong	20,764	21,096	28,929	32,391	12,905	32,828	38,849	56,529	55,335	56,274	351,400
Tangile	2,106	2,762	3,999	5,249	3,890	14,682	15,460	28,961	25,389	21,775	123,773
Guijo	14,107	14,231	18,579	17,279	7,841	19,701	15,650	16,685	16,857	17,801	158,231
Yakal	8,225	8,150	14,491	21,770	5,593	15,115	14,714	16,471	11,963	9,162	125,654
Ipil	13,717	12,296	17,237	15,791	7,535	17,602	12,089	14,147	16,629	15,498	142,541
Molave	8,928	7,978	9,991	9,363	4,783	9,753	10,546	10,788	13,582	22,233	107,040
Narra	5,744	4,996	8,474	8,877	3,941	8,467	9,868	7,970	5,904	7,848	72,089
Kalantas	3,174	1,368	938	3,820	886	2,423	1,999	4,574	7,381	4,975	31,038
Paloaapis						2,222	1,631	2,723	3,042	8,863	18,481
Manggachapui						1,469	1,859	2,666	2,916	2,214	11,124
Dungon	2,453	1,693	1,213	981	601	2,199	1,467	1,127	1,592	1,318	14,594
Tindalo	954	1,018	794	932	484	914	1,181	1,115	1,145	826	9,368
Akle	809	867	1,295	1,690	729	1,237	1,498	1,088	798	870	10,981
Lumbayau									6,085	4,415	10,500
Pagatpat									1,502	849	2,351
Other species:											
First group	574	322	707	1,000	687	2,196	2,190	3,074	1,084	1,416	13,250
Second group	6,667	6,644	7,988	8,543	3,266	9,373	6,940	7,988	6,432	7,779	71,570
Third group	8,316	10,927	11,796	8,711	2,999	7,557	6,920	5,214	9,895	8,611	80,946
Fourth group	36,786	41,655	42,981	59,855	25,613	73,017	60,130	56,738	47,661	80,988	525,369
Total	176,758	182,945	225,548	277,171	101,502	294,758	276,268	341,442	366,891	382,060	2,625,348

TABLE NO. 3.—*Revenues derived from the sale of forest products and expenditures of the Bureau of Forestry since its organization, April 14, 1900.*

Fiscal Year.—	Revenue.	Expense.	Surplus.	Expense.
				Per cent.
1901 to 1906	₱2,268,591	₱1,118,887	₱1,149,704	49
1907	191,080	105,050	86,030	55
1908	211,571	107,242	104,329	51
1909	251,380	115,049	136,331	45
1910	271,582	152,161	119,421	56
1911	334,763	160,476	174,287	48
1912	354,685	200,840	153,845	57
1913	390,664	227,048	163,616	59
1913 (July to December 31)	160,913	141,131	19,782	88
1914	442,661	256,990	185,671	58
1915	425,817	274,176	151,641	64
1916	494,447	285,708	208,739	58
1917	536,328	281,126	255,202	53
1918	650,692	334,254	316,438	51
Total	6,985,174	3,760,188	3,225,086	53.83

TABLE NO. 4.—*Revenue from sale of forest products, January 1 to December 31, 1918.*

Province.	Charge on forest products.							Total.
	Timber.					Firewood.		
	First group timber, ₱2.50 per cubic meter.	Second group timber, ₱1.50 per cubic meter.	Third group timber, ₱1 per cubic meter.	Fourth group timber, ₱0.50 per cubic meter.	Bakauan and tangal, 20 centavos per cubic meter.	Other, 10 centavos per cubic meter.	Minor products.	
Abra	₱2,308.67	₱1,046.65	₱168.05	₱216.54	₱27.50	₱248.35	₱65.29	₱4,081.05
Agusan	335.61	32.08			10.33	57.00	973.85	1,408.87
Albay	2,277.06	1,224.33	2,575.52	1,719.22	865.13	508.39	3,222.78	12,392.43
Ambos Camarines	1,175.90	1,316.20	3,173.69	2,233.48	2,060.75	2,260.28	11,424.55	23,644.85
Antique	220.34	76.15	89.30	136.17		18.10	224.31	764.37
Bataan	47.71	2,230.86	9,863.38	5,415.21	697.99	3,125.02	1,968.49	23,348.66
Batanes								
Batangas	950.54	281.25	169.66	127.56	18.75	680.82	1,988.92	4,217.50
Bohol	461.60	109.43	54.66	434.44	903.32	1,313.10	362.52	3,639.07
Bukidnon	16.40	4.08						20.48
Bulacan	1,119.84	1,180.45	1,102.62	4,071.51	107.48	647.14	1,068.48	9,297.52
Cagayan	13,908.93	1,435.97	2,297.56	1,000.32	129.00	503.08	10,611.95	29,886.81
Capiz	280.06	229.06	372.14	1,716.05	1,194.82	1,767.84	712.77	6,272.74
Cavite				3.90		594.74	225.95	824.59
Cebu	722.60	487.14	137.45	634.19	1,675.67	974.41	851.15	5,482.61
Cotabato	8,346.58	3,886.48	1,063.82	2,804.87	71.67	87.12	124.77	16,385.31
Davao	1,251.99	65.67	55.75	291.82	260.00	517.97	1,387.58	3,830.78
Ilocos Norte	964.20	328.77	127.28	155.76	100.89	80.20	144.05	1,901.15
Ilocos Sur	16.11	47.24	20.92	14.87	1.50	148.08	623.88	872.60
Iloilo	1,699.96	978.80	637.55	913.04	1,266.28	4,178.66	3,010.91	12,680.20
Isabela	8,755.82	2,336.49	952.53	368.73	69.70	85.64	110.94	12,679.85
Laguna	60.84	432.22	1,364.87	1,990.03	6.80	685.84	1,166.23	5,706.83
La Union	276.82	161.46	47.61	21.90	1.60	10.69	333.78	853.86
Lanao	103.17		4.82	69.43	3.00	65.81	84.97	331.20
Leyte	4,727.90	1,115.79	2,520.39	4,677.71	1,355.07	152.45	2,388.30	16,937.61
Manila	39,047.24	16,256.66	64,531.45	57,817.92	1,972.23	1,783.09	4,383.78	185,792.37
Mindoro	2,479.75	1,373.22	833.50	1,530.23	292.12	399.46	2,260.62	9,168.90
Misamis	725.60	291.24	149.82	625.86	29.74	26.79	996.78	2,845.83
Mountain Province	814.39	280.83	114.56	6,054.08		2,446.86	649.07	10,359.79
Negros Occidental	2,275.59	838.22	1,116.35	3,561.66	2,886.82	1,582.69	4,970.42	17,231.75
Negros Oriental	382.47	213.36	116.29	274.84	3.80	256.24	3,749.09	4,996.09
Nueva Ecija	2,167.47	426.03	89.41	324.80	25.66	231.36	1,920.20	5,184.93
Nueva Vizcaya	585.97	6.26	5.10	80.04			3.40	680.77
Palawan	362.56	21.21	3.36	4.96	180.55	25.00	2,332.53	2,930.17
Pampanga	439.11	562.19	333.85	505.55	53.45	257.51	296.56	2,997.22
Pangasinan	3,689.84	3,604.23	3,156.18	1,232.00	2,084.59	838.82	971.85	15,577.06
Rizal	171.95	167.35	119.18	924.91	46.20	1,373.98	2,072.21	4,875.78
Romblon	185.15	35.25	182.01	587.00		3.75	416.28	1,309.44

Samar	1,322.17	1,438.76	1,327.12	1,382.18	860.71	164.79	2,852.62	9,348.20
Sorsogon	5,913.55	1,957.96	1,786.56	4,164.85	1,248.46	817.10	4,286.22	20,169.70
Sulu	6,518.13	544.88	....	309.32	863.65	8.25	375.66	8,614.89
Surigao	738.58	176.57	227.17	369.78	240.10	34.18	2,148.92	3,980.80
Tarlac	263.70	102.24	25.14	24.01	31.65	1,102.81	969.34	2,518.89
Tayabas	47,346.82	5,286.95	4,153.16	2,455.02	6,995.63	5,118.56	13,848.37	84,699.51
Zambales	1,087.95	833.52	2,197.01	498.50	481.04	972.93	938.00	7,003.95
Zamboanga	11,306.76	7,361.92	11,284.51	16,948.82	1,265.90	120.38	4,158.35	52,946.14
Total charges	158,649.14	56,275.06	112,129.41	117,358.26	26,963.48	31,327.23	86,282.36	588,984.94
Total fines and penalties	19,692.76	5,005.96	6,372.39	11,283.27	3,420.57	4,993.50	10,938.23	61,706.68
Grand total	178,341.90	61,281.02	118,501.80	128,641.53	30,384.05	36,320.73	97,220.59	650,691.62

TABLE NO. 5.—*Timber licenses in force during fiscal year 1918 (January 1 to December 31, 1918.)*

Province.	Timber licenses.					Gratuitous licenses.				Total.
	For less than 100 cubic meters.	For 100 cubic meters and less than 1,000 cubic meters.	For 1,000 cubic meters and over.	License agreements.	Total commercial licenses.	For personal use.		For public works.	Miner's gratuitous licenses.	
						Inside communal forests.	Outside communal forests.			
Abra	42	50			92		15	3		18
Albay	8	26	10		44	40	92	1	1	134
Ambos Camarines	26	60	6	1	93	21	21	4	20	65
Antique	7	2			9	5		1		6
Bataan	42	33	21	1	97	1		4		5
Batanes										
Batangas	8	11	1		20		2			2
Bohol	14	10			24	9	22	8		39
Bulacan	2	61	3		66		16	5	8	29
Cagayan	6	103	6		115	43	19	10	3	75
Capiz	29	46	2		77	14	4	6		24
Cavite										
Cebu	11	10	2		23	11	19	2	2	34
Ilocos Norte	35	26	3		64	20		9		29
Ilocos Sur	14				14	12	1	4		17
Iloilo	8	28	2		38	1		1		2
Isabela	52	32			84	49	14	8		71
Laguna	33	43	2		78	5	20	2		27
La Union	3	6			9	24				24
Leyte	51	75	7		133	58	192	8		268
Mindoro	19	55	12		86	1	70	1		72
Misamis	19	7	2		28	11	47	2		60
Department of Mindanao and Sulu:										
Agusan	6	9	2		17	2	37	2	1	42
Bukidnon		1			1					
Cotabato	3		4		7					
Davao	34	29	1		64			3		3
Lanao	11		2	1	14			8		3
Sulu	1	3	8		12			1		1
Zamboanga	33	18	15	2	68	9	62	4		75
Mountain Province	98	19	8	2	127	7	28	10	8	53
Nueva Ecija	21	33	2		56	32	12	2		46
Nueva Vizcaya	16	1			17		24	1		25
Occidental Negros	13	50	11	2	76	9	4	2		15
Oriental Negros	9	14	1		24	12	4	1		17
Palawan	17	4	34		55		30	4	2	36
Pampanga	1	13	2		16			3		3
Pangasinan	28	83	1		112	31	16	8		57
Rizal	13	21			34	2	1			3
Romblon	6	11	1		18	1	12	2		15
Samar	53	62	5		120	119	35	4		158
Sorsogon	64	61	5		130	5	87	3	10	105
Surigao	46	3	4		53	18	29	3	1	61
Tarlac	4	11	1		16	13	48	1		62
Tayabas	50	140	34	1	225	45	5	6	3	59
Zambales	14	30	14		58	19		3	1	25
All provinces								1		1
Total	970	1,300	234	10	2,514	649	990	146	60	1,845

NOTE.—In Cagayan, Isabela, Nueva Vizcaya, La Union, Abra, Mountain Province, Ilocos Sur, Pangasinan, and Nueva Ecija, 1,014 licenses were issued for building tobacco curing houses.

TABLE NO. 6.—*Report of utilization of forest products from public forests of the Philippine Islands during the fiscal year 1918 (January 1 to December 31, 1918).*

Province.	Timber.					Firewood.		Charcoal.	Dyewood.	Tanbark.	Dyebark.
	Group.				Total.						
	First.	Second.	Third.	Fourth.		First class.	Second class.				
	Cu. m.	*Cu. m.*	*Cu. m.*	*Cu. m.*	*Cu. m.*	*Cu. m.*	*Cu. m.*	*Cu. m.*	*Kilos.*	*Kilos.*	*Kilos.*
Abra	777	696	141	434	2,048	12	2,752				
Albay	891	595	1,599	1,622	4,707	3,339	3,089	15		246	
Ambos Camarines	574	2,138	6,307	6,009	15,028	11,258	41,758			232,118	2,330
Antique	50	14	38	125	227	180	114			8,392	
Bataan	43	2,842	32,473	31,892	67,250	4,139	45,224	1,407		4,260	388
Batangas	83	68	44	74	269		14,168	1		55,225	
Bohol	137	229	35	844	1,245	10,045	14,096			9,399	
Bulacan	314	710	1,112	5,503	7,639	1,003	6,222	2,414		27,433	
Cagayan	4,968	680	1,613	1,481	8,742	458	5,177			30,151	9,000
Capiz	148	46	254	2,066	2,514	7,254	53.910	200		8,809	1,082
Cavite				4	4		9,900	182		22,891	
Cebu	95	80	107	589	871	465	6,001	125		22,968	
Ilocos Norte	312	176	101	273	862	122	2,126			75,352	
Ilocos Sur	6	3	4	20	33	4	3,701			90,297	
Iloilo	103	29	124	680	936	2,540	40,179	260	323,331	350,883	
Isabela	2,602	969	625	537	4,193	9	824				
Laguna	18	192	500	708	1,418		7,188	5,403		48,420	
La Union	86	78	24	2	190	4	200			68,924	28,000
Leyte	1,404	422	1,811	6,125	9,762	4,386	3,408	44		50	235
Mindanao and Sulu:											
1. Agusan	156			7	163		3				
2. Bukidnon	8			8	16			10			
3. Cotabato	2,802	1,586	790	3,688	8,146	455	696				
4. Davao	321	35	759	2,520	3,635	366	1,107	240		1,864	
5. Lanao	25	147	6,616	14,002	20,790		895				
6. Sulu	1,424	201		297	1,922	1,562	281	34		101,822	
7. Zamboanga	2,980	3,049	8,047	24,271	38,347	1,075	5,046	290		162,097	
Mindoro	1,963	5,182	1,869	3,703	12,217	7,408	8,947			84,884	25,981
Misamis	241	146	113	789	1,289	162	867			6,007	40
Mountain Province	583	251	1,305	9,981	12,120		20,875	25		28,219	
Negros Occidental	1,156	912	15,844	59,048	76,960	12,236	15,500	241		4,700	42
Negros Oriental	184	118	69	199	570	19	1,872			700	
Nueva Ecija	668	277	142	420	1,507		10,896	74		23,979	78
Nueva Vizcaya	123	20	4	2	149		702				
Palawan	12,198	2,485	1	139	14,773	614	2,681			126,046	51,925
Pampanga	98	302	911	789	2,100	798	2,249	1,148		3,515	
Pangasinan	1,223	1,811	2,119	1,660	6,813	18,615	5,461	25		127,954	1,118

TABLE NO. 6.—*Report of utilization of forest products from public forests of the Philippine Islands during the fiscal year 1918 (January 1 to December 31, 1918)*—Continued.

Province.	Timber.					Firewood.		Charcoal.	Dyewood.	Tanbark.	Dyebark.
	Group.				Total.	First class.	Second class.				
	First.	Second.	Third.	Fourth.							
	Cu. m.	*Cu. m.*	*Cu. m.*	*Cu. m.*	*Cu. m.*	*Cu. m.*	*Cu. m.*	*Cu. m.*	*Kilos.*	*Kilos.*	*Kilos.*
Rizal	39	77	96	889	1,101	37	19,416	1,255	725	36,664	2,480
Romblon	42	20	128	1,554	1,744		15			108	
Samar	621	931	886	1,836	4,274	4,583	352			85,942	
Sorsogon	2,676	1,862	1,440	5,290	11,268	4,778	9,024	34		35,042	4,200
Surigao	552	82	173	719	1,526	3,415	1,212	16		51,052	
Tarlac	101	58	91	110	360	66	15,329	159		15,095	
Tayabas	15,703	3,531	5,833	3,455	28,522	30,749	198,063	1,476		57,8[illegible]0	21,895
Zambales	615	587	1,825	788	3,865	2,275	9,098	464		4,940	20
Total	57,853	33,587	95,523	195,097	382,060	184,431	588,109	15,392	324,056	1,978,786	148,764

Province.	Woodoils.	Almaciga.	Gutta-percha.	Split rattan.	Unsplit rattan.		Diliman.	Stone.	Lime stone.	Gogo.
					Over two cm. diameter.	Two cm. diameter or less.				
	Liters.	*Kilos.*	*Kilos.*	*Kilos.*	*Lin. m.*	*Lin. m.*	*Kilos.*	*Kilos.*	*Kilos.*	*Kilos.*
Abra				278	81,174	197,524			4,000	
Albay				12,535	68,409					
Ambos Camarines		1,155		1,228,425	106,773	617,685	3,713		40,240	20
Antique				11,701		50	1,161			
Bataan				177,873	21,440	374,007	4,750		4,148	4,167
Batangas				128					368,089	25,460
Bohol	197	40		5,420			130			156
Bulacan		152		84,768	207,440	513,626	160			25
Cagayan	100	62,189		787,870	961,505	822,932	1,350			2,907
Capiz		200		11,451	2,000		318			118
Cavite				50						264
Cebu				8,699						24
Ilocos Norte				2,958					28,100	
Ilocos Sur								94,908	115,562	
Iloilo		846		27,924			2,175			
Isabela				4,194	42,400	128,196				
Laguna				23,008	16,490		1,718	820		408
La Union										31
Leyte	172			139,574	42,577	140,106	11,818	700		

Mindanao and Sulu:										
1. Agusan				63,218	52,920	93,480		190		
2. Bukidnon				18,563						
3. Cotabato			896	3,426		17,260				
4. Davao		9,626		5,687						
5. Lanao				11,517		1,000				
6. Sulu				806		3,500				
7. Zamboanga		1,819	10,872	42,827	625	20,280				
Mindoro				100,997		72,350	75,222			4,214
Misamis	900			42,148		100	335			
Mountain Province				272,085	67,480			105,527		
Negros Occidental	9,519			444,820	15,752	52,180	18,216	84		4,769
Negros Oriental	54,155	7,200		270,213	24,835		2,380			6,575
Nueva Ecija				62,389	4,140	262,234	1,481			55,175
Nueva Vizcaya										
Palawan		35,146		12,522	2,850	470,065				79,076
Pampanga				35,470		36,950		692		382
Pangasinan	116			118	18,900	36,800				1,083
Rizal				133,829	1,324	10,050	817			4,541
Romblon	14,634	13,788		2,780	7,400	53,150				
Samar	5,219			194,634	8,450	2,880	8,670	5		
Sorsogon	6,534	430		360,040			14,049			1,772
Surigao	600			67,924		28,750				3
Tarlac				17,553	131,025	130,525	204			15,551
Tayabas		84,660		1,864,678	1,713,890	5,559,453	7,792	750		1,089
Zambales				1,465,571	82,050	411,525				17,416
Total	102,146	217,251	11,768	7,920,066	3,631,849	10,066,058	156,454	203,183	555,184	225,176

NOTE.—No forest products have been invoiced in the Province of Batanes during 1918.

TABLE NO. 6-b.—*Statement of forest products, cut or gathered from registered private woodlands during fiscal year 1918.*

Province.	Timber.					Fire-wood.	Charcoal.	Tanbark.	Dyebark.	Rattan.		White earth balls.
	First group.	Second group.	Third group.	Fourth group.	Total.					Split.	Unsplit.	
	Cu. m.	*Cu. m.*	*Cu. m.*	*Cu. m.*	*Cu. m.*	*Cu. m.*	*Kilos.*	*Kilos.*	*Kilos.*	*Kilos.*	*Lin. m.*	
Albay	3	4	62	236	305	96						
Ambos Camarines						29						
Bataan	10	11	163	27	211	2,712						
Batangas	17	124	2	10	153	2,345		116,399	15,000			
Bulacan	1		1	60	62	4,008	23	611				
Cagayan						305						
Capiz				7	7	535						
Cavite						8,206	100	10,780				
Ilocos Sur		1			1			3,017				
Iloilo				6	6	1,945			3,782			
Isabela	7		10		17							
Laguna						85,622	5,388	12,570				4,780
La Union				1	1							
Mindanao and Sulu:												
1. Davao						15						
Mindoro	6	2			8							
Negros Occidental	7	92	538	557	1,194	10,612						
Nueva Ecija	170	192	16	6	384							
Palawan	123				123							
Pampanga		4	51	4	59	85,639	939					
Pangasinan	3				3	45						
Rizal	45	1	8	22	76	4,360	45	2,106		242		
Romblon			11	19	30	10						
Sorsogon	14	17	30	29	90							
Surigao	1		12	3	16							
Tarlac	113	152	18	31	314	22,893	186					
Tayabas	18	3	6	3	30	3,368						5,000
Total	538	603	928	1,021	3,090	182,740	6,681	145,483	18,782	242		9,780

TABLE NO. 7.—*Minor product licenses in force during fiscal year 1918 (January 1 to December 31, 1918).*

Province.	Firewood.	Charcoal.	Dyewood.	Tanbarks and dye barks	Wood oils.	Almaciga resins and others.	Gutta percha.	Rattan and diliman.	Gogo.	Others.	Total.
Abra	24			1		1		18		3	47
Albay	55			7				54		2	118
Ambos Camarines	80	1		12		20		203	2	4	322
Antique	6			1				30		2	39
Bataan	51	12		1		4		98	21		182
Batanes											
Batangas	17			2		3				7	29
Bohol	27			2							29
Bulacan	5	13				3	1	30	5		57
Cagayan	39	1		3	1	37		113	1	1	196
Capiz	57	1		3				26		2	89
Cavite	7							3		1	11
Cebu	43	10		2				7	1		63
Ilocos Norte	14			1				6		4	25
Ilocos Sur	9	1		3		1				19	33
Iloilo	49	6	18	19	1	4		19	1	12	129
Isabelá	18					6		31			55
Laguna	13	6				2		25	5	20	71
La Union	4	1		1					1		7
Leyte	48	1	2	3	1	2		52		43	152
Mindoro	56	4		39				81	23	1	204
Misamis	12			2				20			34
Department of Mindanao and Sulu:											
Agusan	5							36			41
Bukidnon								18			18
Cotabato	7					1	3	5		5	21
Davao	50	6		1		10		19			86
Lanao	14	1	1	3		1	2	7	1		30
Sulu	9			5							14
Zamboanga	80	3		25		7	9	58			182
Mountain Province	28	1		1		5		59		2	96
Nueva Ecija	23	3		2		1		51	48		128
Nueva Vizcaya	5		1					1			7
Occidental Negros	82	1		7	30	8		292	46	18	484
Oriental Negros	13				1			69	11	15	109
Palawan	58			45		27		33	11		174
Pampanga	9	7						5			21
Pangasinan	62	6	4	8				5	3	2	90
Rizal	32	8		3		1		22	10		76
Romblon	5			1	4	8		8	1	1	28
Samar	38			3	4	1		83		2	131
Sorsogon	78	6	2	11	2	2		93	5	2	201
Surigao	23	2		6		1		31	1	6	70
Tarlac	11	4		1				9	7	1	33
Tayabas	131	14		50		49		152	22	24	442
Zambales	59	12		6	1	6		48	18		150
Total	1,451	131	28	280	45	211	15	1,915	244	199	4,519

TABLE NO. 8.—*Statement showing the quantity and value of minor forest products exported during the fiscal year 1918 (January 1 to December 31).*

	Kilos.	Value.
Copal (almaciga):		
United States	433,441	₱126,168
Spain	3,000	1,200
British East Indies	65,682	10,206
Australasia	4,993	1,247
Total	507,116	138,821
Elemi (pili resin):		
United States	17,186	9,828
Gutta-percha:		
British East Indies	2,834	2,007
Rubber:		
United States	84,070	74,710
British East Indies	415	500
Total	84,485	75,210
Lumbang (candle nut) oil:		
United States	184,428	129,838
Sappan wood (sibukau):		
China	337,186	31,155
Hongkong	482,534	62,501
Total	819,720	62,501
Total		418,205

Table No. 9.—*Statement of appropriation and expenditures Bureau of Forestry (January 1 to December 31, 1918).*

Appropriation:		
Act No. 2727	₱339,800.00	
Deficiency Appropriation Act No. 2783	12,300.00	
Total		₱352,100.00
Expenditures:		
Salaries and wages	237,581.63	
Furniture and equipment	8,000.00	
Traveling expenses of personnel	43,129.88	
Rentals of buildings and grounds	3,110.43	
Freight, express, and delivery service	2,000.00	
Printing and binding reports, documents and publications	5,000.00	
Postal, telegraph, and cable service	4,498.78	
Illumination and power service	1,567.25	
Plant and equipment repair service	1,237.38	
Contingent service	1,411.80	
Consumption of supplies and materials	24,704.59	
Travel expense of persons not Government employees	93.00	
Total expenditures		332,334.74
Balance January 1, 1919		19,765.26
Appropriation for Cebu reforestation (Act No. 2649).		
Balance January 1, 1918		2,914.41
Expenditures:		
Salaries and wages	1,046.41	
Furniture and equipment	1.55	
Traveling expenses of personnel	248.28	
Rentals of buildings and grounds	5.50	
Freight, express, and delivery service	32.95	
Postal, telegraph, and cable service	9.76	
Equipment repair service	0.45	
Consumption of supplies and materials	574.24	
Total expenditures		1,919.14
Balance January 1, 1919		995.27
Appropriation for construction of six forest stations (Act No. 2786)		5,000.00
Expenditures		1,482.76
Balance January 1, 1919		3,517.24
Appropriation for road construction, Los Baños, (Act No. 2786)		10,000.00
Expenditures		2,060.81
Balance January 1, 1919		7,939.19
Statement of Bureau of Forestry appropriations, expenditures and revenues for fiscal year 1918:		
Appropriations		355,014.41
Revenue		650,691.66
Expenditures		334,253.88
Surplus		316,437.78
Percentage of expenditures to revenue		.51

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THE GOVERNMENT OF THE PHILIPPINE ISLANDS
DEPARTMENT OF AGRICULTURE AND NATURAL RESOURCES
BUREAU OF FORESTRY

Annual Report of the Director of Forestry of the Philippine Islands

For the Fiscal Year Ended December 31, 1919

ARTHUR F. FISCHER
Director of Forestry

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ANNUAL REPORT OF THE DIRECTOR OF FORESTRY

MANILA, *February 21, 1920.*

SIR: I have the honor to submit herewith the Annual Report of the Bureau of Forestry for the fiscal year 1919, covering the period from January 1 to December 31, 1919.

LEGISLATION

During the past year few bills touching upon forestry matters were introduced in either house of the Legislature.

Further changes in the wording and certain additions were proposed by this Bureau for Chapter 47 (known as the Forest Law) of Act 2711, which latter is the Administrative Code of the Philippine Islands. Also, this Bureau coöperated with the Bureau of Internal Revenue in requesting changes, and discussing possible changes, in the sections of the Administrative Code under the heading of the Bureau of Internal Revenue which treat of forest products.

Special legislation was proposed by this Bureau for the regulation of fisheries and touching the game laws of the Islands. Particular attention in respect of legislation was given to the question of grazing on public lands. This has become a considerable problem, there being as yet no sections of the aforesaid Forest Act applicable to the regulation of grazing.

PERSONNEL

Given the present high cost of living and considering in comparison therewith the range of salaries of the personnel of the Bureau, the most important question in the Bureau at the present time is the salary paid our men—particularly the insufficient compensation available for the rangers. It has been most difficult to hold to this service rangers of training and of worth proven in experience, for numerous requests have been made, by foreign governments and by private entities in the Orient, for Filipinos of our trained personnel, and it has been the policy to accede to such requests as far as was possible without crippling our own service. The question of higher technical personnel is also most pressing. Salaries for technically trained foresters (who usually have more than one university degree) are not paid in proportion to their work and the expert knowledge required of them. Division chiefs are still on the same salary basis as four years ago; while salaries paid in other bureaus are in general higher than those paid in the Bureau of Forestry. Division chiefs should obtain at least ₱6,000 per annum; with the smaller salaries paid for foresters, it is practically impossible to obtain trained men from the United States. No Filipinos trained in special forestry lines are available at the present time and those at present studying in the United States will not be available for three or four years, and even these men, when they return, will have to obtain practical experience before being able to take over positions now being held by experienced American foresters. Several men in this office, besides being foresters, are trained engineers and in point of ability could very easily take hold of any district engineer's position in the Bureau of Public Works, where higher salaries are offered.

Again during the year 1919 sickness has been widely prevalent among the men of the field force and this has been a contributing factor in resignations. For other reasons, also, applications for transfer and resignation have increased, yet were generally refused, as no men were available to carry on the work. All this has made the position of the Director a difficult one, and the recommendations and statements made in the report of last year in regard to this matter still hold good.

The following changes in personnel have occurred during the year: The temporary lumber inspector of this Bureau resigned and went to the United States and a forester of this Bureau was appointed to this position. One ranger-scaler took leave of absence and went to the United States to take up advanced forestry, and it is believed that he will not return for at least three years. Two rangers were dismissed for the good of the service and five resigned. Of these latter, one took up the study of law, three went into business for themselves, the fifth accepted employment with a commercial firm.

The following appointments were made during the year: Messrs. Otto W. Pflueger and Lyman H. Taft were appointed foresters of this Bureau. (Mr. Pflueger has had six years' experience as Instructor in forestry in a University in the United States, besides having been with the forestry regiment in France during the late war.) During the year, nineteen graduates of the Forest School were given appointments as rangers. Assistant Forester Florencio Tamesis was granted a scholarship in lumbering; Forest Supervisors Nazario Peñas and Felix Franco, scholarships in logging engineering and forest management, respectively, and Ranger Luis J. Reyes, assistant to the wood expert, a scholarship in wood technology, all three of these being sent to different universities in the United States.

The entire force on December 31, 1919, was made up of 206 employees having classified status and 101 employees rated as temporaries.

The classified force consisted of: 1 Director, 9 foresters, 1 dendrologist, 1 lumber inspector, 1 wood expert, 2 assistant foresters, 6 forest supervisors, 128 rangers, 9 draftsmen, 45 clerks, and 3 messengers. The temporary employees were: 1 temporary ranger, 1 proof reader, 5 nurserymen, 7 laborers, 5 carpenters, 2 varnishers, 72 guards, 2 watchmen, 5 janitors, and 1 chauffeur, making a grand total of 307 employees.

ORGANIZATION

A new division, designated the Division of Accounts and Property, was created, as required by the increase in the volume of financial and property work, it being necessary to give the Chief Clerk more time to devote to the duties appertaining to his position both in respect of administration and with a view to enabling him systematize the clerical work of the Bureau, which systematization was greatly needed, due to the continuing inadequacy of the clerical personnel.

Two new sections were organized under the Division of Forest Management.

EFFICIENCY

The general efficiency throughout the Bureau can not be said to have materially increased, this principally owing to the fact of the increased volume of work and the question of personnel. Such sickness as was generally prevalent, as stated above, could not be conducive to any added efficiency. Field work has been carried on to the utmost possible extent with the personnel available, yet with the tremendous increase of work during the year, it had of necessity to be held up because of lack of physically effective workers. The inadequacy in number of the clerical help, above referred to, also could not tend toward any increase in efficiency, but it is gratifying to be able to state that the clerical force has shown loyalty and *esprit de corps* in endeavoring to carry on by assuming increased duty, necessitating frequent overtime work. The undersigned feels, however, that a more or less continual overloading of underpaid clerks must finally result in a decreased efficiency throughout the entire organization.

DIVISION OF FOREST MANAGEMENT

The Division of Forest Management is charged with the use and protection of the public forests of the Philippines. The work of this division consists in issuing licenses for forest products; inspecting the operations of licensees, and supervising the work of all field men. At the end of the year there were on the rolls of this division the following employees: the Division Chief, an Assistant Chief, four foresters, one assistant forester, six forest supervisors, one hundred and seventeen rangers, and thirty-three guards. In addition to these, there were six clerks in the license section.

Of the above named, the assistant forester and two forest supervisors are on leave of absence in the United States, where they were sent as pensionados of the Philippine Government.

During the year two new sections were organized in the Division of Forest Management: (1) A section of Inspection, under the direct charge of the assistant chief of the division, in which were enrolled five of the forest supervisors. This section, as its name indicates, is designed to insure the supervision and control of the work of the field men by means of frequent inspections. (2) A special permits section under a forest supervisor whose work consists of supervising the handling of applications and granting of special permits for the use of forest lands, such as pastures, saltworks, fishponds, etc., as provided in section 1838 of the Administrative Code, and of attending to the leasing of mangrove swamps by contract.

Owing to the lack of personnel for the proper administration of the several forest districts, due to sickness, absence on accrued leave, and to the formation of a large party for reconnaissance work in Davao, it was not possible to push the work of leasing the mangrove swamps under special license agreements. However, the organization of the special permits section in the latter part of the year revived this project and gave it new life, and it is now hoped that this work can be carried on without any setback.

FOREST DISTRICTS

The present subdivision of the Philippines into thirteen forest districts, or administrative units, has proven so satisfactory that no change was called for during the past year.

However, due to an increase in personnel, it became possible to assign rangers to establish the following new stations in the indicated Districts.

Bangued, Abra Province	District No. 2.
Tagudin, Amburayan Subprovince	District No. 3.
Katabañgan, Ragay, Ambos Camarines	District No. 6.
Virac, Catanduanes	District No. 6.
Laoang, Samar	District No. 10.

INSPECTION

During the year 1919, detailed inspections by the supervising personnel of the Manila office have been made in all thirteen districts—covering 32 stations.

District No.	Station.	Inspected by—	1919.	Report.
1	Echague	Buenaventura	Oct. 16-19	1
	Ilagan	do	Oct. 23-24	1
	Tuguegarao	do	Oct. 26	1
	Aparri	do	Oct. 27-Nov. 1	1
2	Vigan	do	Nov. 8	1
3	Baguio	Director	June	
4	Bayombong	Buenaventura	Oct. 13-14	1
	Dagupan	Peñas	July 1	
	do	Director	June	
	Cabanatuan	do	do	
	Cuyapo	do	do	
	Dagupan	Alvarez	July 1	
	Cabanatuan	do	do	
	Cuyapo	do	do	
5	Los Baños	Director		
	Calauag	Pray	March 1	
6	Naga	Peñas	May 3 and July	2
	Catabañgan	Buenaventura	Dec. 15-19	
	Naga	do	Dec. 1918	
	Legaspi	do	Dec. 1918	
	Naga	Peñas	March 21	
	Legaspi	do	March 20	
	Paracale	do	May 1	
7	Cadiz	Suyat	Dec. 15-16	1
	Fabrica	do	Dec. 16	1
	Iloilo	do	Dec. 18	1
	New Washington	do	Dec. 21	1
8	Zamboanga	Director	May 1	
	Dapitan	do	do	
	Kolambugan	do	do	
	Davao	Medina	do	
9				
10	Surigao	Director	April 30	
11	Norzagaray	Peñas	May 20	
	Moron	Franco	Jan. 25	
	Orani	do	May 1	
	Limay	do	July 1	
	do	Director		
	Orani	Buenaventura	Sept. 1	1
	Moron	do	do	1
	Norzagaray	Alvarez	Aug. 1	
12				
13	Dumaguete	Director		

The foregoing table shows that there were more forest districts inspected in 1919 than in the past year.

These inspections not only are made the occasion for thorough verification of the activities of the several employees of the Bureau making up the field force, but measures are taken to increase their efficiency, by clear explanations of the policy of the Bureau in the respective lines of work, as well as by assistance in systematic arrangement of the records and files of field offices the same as those of the Manila office.

It is hoped that with the availability of the eight supervisors provided for by the 1920 budget, each forest district can be given adequate inspection at least twice during the present year.

LICENSE STATISTICS

During the year 1919, ordinary timber licenses increased 436 in number over those issued in 1918, a total of 2,950 being in force at the end of the year. (This does not include those which were returned or cancelled.) The increase is found to be quite evenly distributed throughout the different license classes.

In respect of gratuitous licenses, there was a decrease of 430 in the number issued during 1919. This diminution occurred in the category of licenses for personal-use cutting outside of communal forests, and undoubtedly was due to the availability of machine-sawn lumber and the excessively high cost of hand sawing.

Of licenses covering minor forest products, a total of 5,179 were issued in 1919, an increase of 660 over the previous year. Firewood licenses showed the largest increase, those for rattan coming next.

OFFENSES OF LICENSEES

Two new causes of trouble in the management and control of the timber and firewood licenses seemed to have reached maximum development during the past year. These were: (1) Trading in licenses, and (2) the attempts by licensees, or persons interested in a license, to enlarge their territory to the prejudice of adjacent licensees.

Of these, the first had reached considerable proportions, as local capitalists were readily induced to make loans on the security of licenses because of the large margin of profit on the forest products concerned. Later, when they would attempt to collect the debt, they in many cases found that a given licensee had at the same time become involved with as many as half a dozen different persons. As soon as a creditor realized his position, he would hasten to the Bureau of Forestry and apply to get the license transferred to himself. This would require an investigation and much long drawn out correspondence before the case could be settled.

The second cause of trouble is the more difficult to resolve (unless it happens that one of the licenses involved is actually and clearly guilty of a violation of the Forest Laws or the Bureau of Internal Rêvenue Regulations), because usually it leads to recriminations and countercharges between the licensees involved, which charges require careful investigation. It usually develops that, while all the parties concerned may be guilty of minor violations of the law, such violations are not sufficiently serious to warrant more drastic action than a reprimand.

Despite the very much greater number of inspections made, there has been a marked reduction in the amount of wasted and abandoned timber reported, and this condition is undoubtedly due partly to the greatly increased price of all forest products, and partly to a realization, on the part of the licensees, that their operations are now almost certain to be inspected.

OFFENSES OF NON-LICENSEES

There have been very few complaints received during the past year of illegal cutting by non-licensees. This is attributable partly to the increased efficiency of the patrol work and the inspection of barrios by the forest guards and partly to the increased supervision given to their cutting areas by the majority of licensees.

CAIÑGINS

The number of illegal caiñgins reported during 1919, as compared with 1918, shows a decrease of 173. The number of

Caiñgin reported during the fiscal year 1919, (January 1 to December 31, 1919).

Province.	Reported by—		Total.	Acted on.		Total.
	Forest officer.	Municipal president.		Convicted.	Acquitted.	
Abra						
Albay	18		18	13	1	14
Ambos Camarines	35	4	39	3	1	4
Antique						
Bataan						
Batanes						
Batangas						
Bohol				6		6
Bulacan						
Cagayan	6		6			
Capiz	17		17	2	1	3
Cavite						
Cebu	40		40	2	1	3
Ilocos Norte						
Ilocos Sur	3		3			
Iloilo						
Isabela	2		2	1		1
Laguna	1		1			
La Union						
Leyte	48	5	53	16		16
Mindoro	21		21	1	1	2
Misamis						
Department of Mindanao and Sulu:						
Agusan	1		1	1		1
Bukidnon						
Cotabato	1		1			
Davao	5		5	2		2
Lanao						
Sulu						
Zamboanga	12		12			
Mountain Province	2		2			
Nueva Ecija	4		4			
Nueva Vizcaya						
Negros Occidental	57		57	24	1	25
Negros Oriental	24		24			
Palawan	19		19	1	2	3
Pampanga	1		1			
Pangasinan	54		54	16		16
Rizal	68		68	11	18	29
Romblon	21		21			
Samar	72		72	22	27	49
Sorsogon	1		1			
Surigao	6		6	1		1
Tarlac						
Tayabas	55		55	30	3	33
Zambales				4		4
Total	594	9	603	156	56	212

NOTE.—It is most probable that several of the reported cases have already been acted upon, but this Office has not been informed of the fact.

successful prosecutions, moreover, was materially greater, being 156 as against 118. These results are especially noteworthy because of the excessive price for rice and the Government propaganda for the raising of increased food crops, both of which had a very unfavorable effect on the control of caiñgins. The better conditions can be directly attributed to the increasing efficiency of the patrol work against caiñgins kept up by rangers and forest guards, and also to the cumulative effect of the instructive talks given by all rangers in the smaller barrios adjacent to the forests, in which talks the advantages of taking up a homestead, as well as the destruction caused by the caiñgin method of agriculture, are especially dwelt upon.

FUTURE SPECIAL WORK

The work of placing the tidal swamps under systematic management as rapidly as they can be surveyed, and the questions of conflicting ownership settled, will be continued.

A policy of establishing small to medium-sized mills whereever suitable conditions offer has already been inaugurated, and a party of four rangers, in charge of a forest supervisor, will be sent early in January, 1920, to the Island of Palawan to make a reconnaissance of two areas which are believed to be suitable for development.

FOREST DISTRICTS REPORTS

The following extracts are made from the reports of the chiefs of the several forest districts. Many of these contain considerable information which it would be desirable to set forth here did not considerations of space forbid. The following extracts have, however, been included to give at least a general idea of the duties of forest officers and of the principal results of their work during the past year.

District No. 1; Headquarters, Aparri, Cagayan.—In spite of the usual complaints of damage from typhoons and rinderpest, activity both in timber and in minor forest products has been very great, due to the heavy demand and the high prices paid. Owing to the installation of electric lighting plants in Aparri and Tuguegarao, respectively, several thousands of posts were required for the transmission lines of these two plants. Rattan went begging the first three quarters of the year, due to the fact that there was little or no baling of tobacco, but it rose to a very high price in the last quarter, when baling of the tobacco crop began. In addition to the sawmill already established at the mouth of the Zinundungan River in the municipality of Gattaran, Cagayan, another was installed during the past year at Abulug, Cagayan.

The attitude of the licensees in the district has become very much less antagonistic; many of them are now in friendly coöperation with the rangers to prevent the making of illegal caiñgins and generally to protect the forests.

Caiñgin making has been materially reduced throughout the district because of the activity shown by the rangers and through the coöperation of the municipal officials and many of the licensees.

The segregation of public lands into agricultural and permanent-forest types was not finished, owing to the lack of personnel, but it is hoped that this coming year will see the completion of this work. In connection with this work, 1,631.7 kilometers of trail notes were taken.

Silvicultural conditions are bad in many of the cut-over areas, owing to the excessive felling of first and second group trees; and recommendation has been submitted that the marking of seed trees be inaugurated to supersede the present requirement of a diameter limit for felling. It is, however, questionable whether there will be sufficient personnel to perform this work. Since the establishment of communal forests was authorized, forty-seven such areas have been set aside in District No. 1.

The collection of fines for infractions of the Rules and Regulations in the district amounted during the year to ₱7,244.44.

District No. 2; Headquarters, Vigan, Ilocos Sur.—During the past year, there was a great demand for lumber and consequently prices have been very high—first group timber bringing up to ₱150 per cubic meter and second group up to ₱70 per cubic meter. In spite of these high prices, the licensees were not able to get out enough timber to satisfy the demand.

Silvicultural conditions in the district have been very good, there being abundant reproduction of most of the important timber trees, both from seedlings and sprouts—though only the sprouts of Narra and Molave persist until they develop into large trees.

No forest fires of any magnitude were reported during the year and even small fires were very infrequent. As a result of this, the grasslands are rapidly being reduced in extent through the invasion of *parang* species. The taking up of homesteads in the more level grasslands is also a very material factor in reducing the extent of these areas.

During the year, there were located four new demonstration reforestation plots; at Pasuquin and Paoay, Ilocos Norte; and at Sinait and Santa Maria, Ilocos Sur; as well as two new forest nurseries: at Barrio Caniao, Bantay, and Barrio Agayaos, Santa, Ilocos Sur.

General conditions throughout the district have been very good, although there was much damage done by floods and typhoons.

District No. 3; Headquarters, Baguio, Mountain Province.—The demand for and the prices of all kinds of forest products have been excellent during the past year. A working plan for the Baguio Working Circle has been completed and submitted for approval. Under this plan the annual cut will not be allowed to exceed the amount of the annual growth, thus guaranteeing the supply of both timber and firewood for an indefinite period. The Santo Tomas concession is again being worked at capacity, the cables which it had been impossible to obtain from the United States during the period of the war having arrived and been put into use. During the past year the Yrisan concession, which was formerly held by the Benguet Commercial Company, was cancelled by the Secretary of Agriculture and Natural Resources, owing to the company's inability to carry on operations.

Little planting has ben done this year on the Antamok Streamhead Plantation, but frequent inspections have been made by forest officers, and the *Pithonia* cuttings have done very well, having flowered and fruited.

Upon the request of the military authorities, a plantation was made on the hill above their Hydro-electric plant, the object being to prevent erosion and rock-slides on the steep rocky slopes above the power plant. The work was done under contract and was supervised by forest officers; some 30,000 cuttings each of Mirasolia (*Pithonia diversifolia*) and Dama de Noche (*Cestrum nocturnum*) were planted, of each of which about 50 per cent are in good healthy condition at the present writing.

During this year the mapping of the Baguio Working Circle was completed. The map shows in detail the character of the land, the vegetation on it, the concession and license areas and other necessary data.

The only mining concern operating to any extent this year was the Benguet Consolidated Mining Company. The Acupan Mining and Milling Company was not able to resume operations, due to lack of machinery. The Hagen and Reynold's partnership was dissolved, but it is understood that other parties have taken an option on their territory.

The project for the establishment of communal forests for all the towns of the Mountain Province has, in view of the adverse recommendation of the provincial governor, been suspended indefinitely.

The number of caiñgin permits issued shows an increase of 315 over 1918, and this is gratifying to note, since it shows that the Igorots are fast becoming amenable to the Forest Laws and Regulations.

The fire season this year has been very severe, 58 fires having been reported, covering an area of 170 hectares, with an estimated number of 38,980 pine seedlings and poles killed or injured. The city fire wardens are no longer stationed at lookout points, but have patrol routes to cover and they report the fires discovered by them to the central office by telephone.

District No. 4; Headquarters, Dagupan, Pangasinan.—The officer in charge of this district reports that although the demand for forest products was excellent and prices greater than ever before, the past year has not been a prosperous one for the licensees, due to the unsettled labor conditions caused by the food crisis and by epidemic. Further he states that, although the number of licensees increased, the production of both firewood and timber fell off slightly, due partly to the decreasing supply of these products and partly to scarcity of labor.

The Zambales Lumber Company, a new firm, was granted a twenty-year concession in Masinloc, Zambales, and a small mill was installed on their area. It is, however, their intention to erect a large modern plant and have it ready to operate before the end of 1920.

Kogon fires were reported during the year covering an estimated area of 2,800 hectares. It is hoped finally to prevent these by an increasingly rapid settlement of the kogon areas by homesteaders.

Due to the tactful treatment of the licensees by the rangers, there has been an improvement in the spirit of the licensees and thir attitude toward the Bureau.

The silvicultural condition of the forests in the district is very unsatisfactory. This is particularly true with reference to the mangrove swamps, in many of which the tree growth has been practically eliminated. This is due to excessive and improper cutting, which can not be controlled with the present insufficient force in this district.

District No. 5; Headquarters, Los Baños, Laguna.—Activity in the lumber industry has been very great in the past year, there being five mills in active operation. Of these, the mill at Calauag has made by far the best showing. The manager of this mill plans to install, during 1920, a band sawmill in place of the circular one now in use.

Due to the very high prices of firewood during the past year, many firewood licensees adopted the policy of felling everything that could be sold, irrespective of the cutting regulations imposed in their licenses—their attitude being that, if they were caught, the extra fine would have been more than offset by the profits from the very high price of firewood.

Fires in District 5 have been very few and these not severe. No special work in mapping and surveying was undertaken during the past year, owing to the lack of personnel, but it is hoped that during the coming year several important reconnaissance projects may be carried out.

Reports have been submitted for communal forests for Baler, Mulanay and Unisan, Tayabas, and Ragay, Camarines. In addition, petitions for the establishment of communal forests have been forwarded from several other towns to the local forest officers for appropriate action.

District No. 6; Headquarters, Naga, Ambos Camarines.—The Christmas typhoon of 1918, with its resultant damage, had created a great demand for timber for repair work. This gave the lumber industry a big impetus during the early part of the year 1919. During the middle part of the year, the operations of the timber licensees were greatly reduced, owing to the sickness of both men and animals, as well as by the extreme food crisis. With the exception of the timber gotten out by the licensees on the northwestern coast of Camarines, practically all the timber is used locally. The Katabañgan sawmill increased its capacity, during 1919 and now turns out over 10,000 board feet daily, practically all of which is shipped to Manila. In connection with the increased activity of this mill, a new forest station was opened at Katabañgan. The licensees in the eastern part of Albay have been very busy furnishing ties, poles and posts for the extension of the southern line of the Manila Railroad from Legaspi to Naga.

The rattan industry fell off during 1919, owing to the decline in hemp, the baling of which is the principal use of the local supply of rattan.

Two important surveys were undertaken during the year, one being the reconnaissance of the mangrove-swamp area of Viga, Island of Catanduanes, under the supervision of Ranger Salvoza, and the other that of the Daet swamps in Camarines.

The total number of ordinary timber licenses in force in the district remained practically the same, but there were numerous changes among the persons holding them, 33 new ordinary timber licenses being granted and 33 gratuitous licenses being cancelled. The one existing license agreement in the district was altered, during the first half of the year, to cover only about one-half of the former area, the portion which was alienated being opened up to ordinary timber licensees.

Six new communal forests were established during the year and two applications therefore are pending inspection.

As a result of coöperation between the municipal and provincial governments to the end of forcing the people to cultivate the kogon and brushland of the district with food crops, much of the waste land of the province has been planted, and it is hoped that in the near future the importation of food crops from outside will by much lessened.

District No. 7; Headquarters, Iloilo, Iloilo.—The lumber industry has enjoyed an unprecedented boom in this district, the large demand from the new sugar centrals for lumber, piles, ties, etc., having given the licensees more orders than they could fill. In spite of this, the prices of sawn lumber averaged lower than the preceding year, due to the establishment of the new lumber yards in Iloilo, breaking the monopoly enjoyed by the single lumber yard existing in 1918. With the exception of those handling first and second group lumber, the people dealing in handsawn lumber have been compelled to give up business, due to the high cost of labor. Firewood has been at a premium in Iloilo and was bringing at the end of the year as much as ₱100 per thousand "rajas" of bakauan. The market for sibukau, almaciga and bayones has been very weak, with prices very low. Split rattan and balau have maintained steady prices.

Forest fires have been reduced to a minimum, owing to the extremely long rainy season. There was but one fire of any importance and that one occurred in the timber section near Pontevedra, Capiz. The damage was small.

There was a substantial increase in the number of licenses granted, both for timber and minor products, during the year and a decrease in the number of gratuitous licenses issued. One new sawmill has been added to the two mills already operating in Negros. The new one is the property of Mr. Walter A. Smith, who is logging part of the area under the Insular Lumber Company's concession and partly on private woodlands.

District No. 8; Headquarters, Zamboanga, Zamboanga.—Cutting was started on the Jolo Teak Reserve the past year by the provincial government of Sulu. Also, over 25,000 ties, mostly of first group timber, were shipped from Sulu Province in one month last year. Transportation facilities have improved during the year, although freight rates were rather high. The Olutanga Lumber Company has almost completed a schooner of its own for transporting its lumber to the Manila market. Information secured from six of the largest mills in the district shows that 49 per cent of the lumber shipped by them went to Manila, while of the remainder, Cebu received 15 per cent, Zamboanga, 12 per cent, miscellaneous ports in Mindanao and Sulu, 19 per cent, other provinces and Shanghai, China, 5 per cent.

The reconnaissance under the direction of Forester Medina with a crew of sixty men, including laborers and students, covering the whole of Davao Province, was begun in March and completed in June. The detailed report will be found in this report under the Division of Forest Lands and Maps.

Ordinary timber licenses in 1919 showed a substantial increase in number over those issued in 1918, while the number of gratuitous licenses fell off by 100. Minor products licenses also showed a substantial increase, there being 512 granted in 1919 as against 370 for 1918.

Substantial increases in the number of homestead, lease and purchase applications were noted during the year 1919.

Five new communal forests were established during the year and two proposed forests were surveyed. One communal forest was certified as more valuable for agriculture than for forest purposes and has been opened for entry under the homestead laws. A new forest is to be located in replacement of the one abolished.

More timber has been cut during the past year by the mills in this district than in any previous year. Two new twenty-year concessions were granted during the year: One to the Basilan Lumber Company, on Basilan Island, and one to the Olutanga Lumber Company, on Olutanga Island, Zamboanga. The mill at Lumarao, which has been idle for some time, is undergoing repairs and will be again operating before April 1st. The provincial government of Sulu purchased the mill formerly owned by Mr. Lyon and is using it to cut up the teak from Jolo. The Basilan Lumber Company has constructed during the year a new mill at Maluso with a capacity of 3,000 board feet daily. A new mill is also being erected in the city of Zamboanga, with a capacity of 2,500 board feet per day, and yet another is going up in Davao Province.

Two new forest stations were completed during the year, one at Naga-Naga, Zamboanga, and one at Port Banga, Zamboanga. During the month of May, the District Office was moved from the Custom House Building into more commodious quarters in the Murga Building, which is more centrally located.

District No. 9; Headquarters, Puerto Princesa, Palawan.—The lumber operations in Palawan have increased to a remarkable extent during the past year. The cutting is, however, confined mostly to the coast, and only Kalantas and Ipil are being logged. A reconnaissance party is to start work in January, 1920, and it is hoped that as a result of its work, areas will be opened up for more progressive logging. Almost all of the labor used in all operations is imported from the Visayan Provinces, since the local labor is not only insufficient, but inefficient. The best market for the timber cut is Manila—only a very small amount being used locally. In general, the silvicultural conditions are satisfactory. Reproduction is good. If licensees are kept out of the cut-over areas, the results will be very satisfactory. Fires are rare.

All classes of licenses showed an increase in the number granted over those of 1918. The licensees are also much more active, due to the high prices and better transportation facilities. There are two sawmills in the district, namely, the one at the Iwahig Penal Colony and that of Licensee Thomas A. Wallace. Neither one of these has operated during the year.

District No. 10; Headquarters, Tacloban, Leyte.—Modern lumbering methods have not as yet been introduced in this district, and although there are five sawmills at present operating, all are small. Most of the lumber produced is sold in Tacloban, but as the lumber requirements are less than the production, the price of lumber has shown a tendency to drop.

The majority of the licensees evidence a friendly spirit towards this Bureau and its representatives. Many of them are beginning to recognize the importance of the public forests, and have coöperated with the rangers in detecting and prosecuting infractors of the forest laws.

In view of the advantages accruing to the holder of a forestry license, it has become necessary to use greater care in issuing them; it is recommended that every applicant for a license be required to file a bond proportionate to the value of the stand of timber on the area applied for.

In general, the silvicultural conditions are good and the damage from windfall and insects during the past year has been negligible.

The dry season of the past year was unusually hot and dry, and several large forest fires have been reported from Masbate, where there are extensive areas of grass land. Two of these fires, the one located south of Barrio Baleno, Masbate, and the other located in Sitio Capday, about 6 kilometers southeast of Aroroy, did considerable damage, each fire spreading over about 100 hectares of forest.

Six hundred and twenty kilometers of trail notes were taken during the year. These surveys were made in connection with inspections of licenses and of public lands.

Although there was a material decrease in the number of caiñgins reported over 1918, (i. e., 159 as against 214), the number of convictions secured was greater, 103 to 57. This is a very satisfactory showing and indicates that the propaganda directed against caiñgin makers by the rangers has begun to bear fruit.

District No. 11; Headquarters, Manila.—During the year 1919, the forest industries have enjoyed unusual prosperity. The Cadwallader-Gibson Lumber Company have been exploiting their concession on the Bataan Peninsula, working the greater part of the time day and night, and are also installing another mill at Paysawan, on the western coast of Bataan. A small circular mill has been established at Barrio Alañgan, Limay, Bataan, by Mr. M. de los Reyes. In Orani, many of the licensees have been cutting bancas (dugout canoes) instead of squared logs, as the net returns are greater and the bancas are much easier to haul out. The firewood industry has continued on the same scale as in 1918, and with good financial retruns.

With the exception of the Cadwallader-Gibson concession area, the silvicultural conditions have been very good.

The only fire of any importance reported was that above the patrol trail in the jurisdiction of Abucay, Bataan, which burned about 20 hectares of commercial forest. The authors of it were certain Christians who induced Negritos to start the fire.

The mapping work done during the year covers the Gordon-Schilling Lumber Company's concession area, the Naval Reserve and also the Macatbas-Tipo watershed. In all, 341.92 kilometers of notes were taken.

Only 66 caiñgin-makers were reported during the year, and of these 19 were convicted and 42 absolved, while 5 were pending judicial action at the end of the year. This showing is remarkably good for a district so densely populated, and indicates that, given the right kind of propaganda and the proper supervision, this evil can practically be eliminated.

District No. 12; Headquarters, Calapan, Mindoro.—There has been a good demand for lumber, with high prices ruling throughout the year, and as a result, practically every foot of accessible forest has been taken up under licenses. All mangrove swamps also were granted under license, and there has been great activity in the firewood business. While there have been some changes among the persons holding the licenses, the number of licenses has remained about the same, owing to lack of additional unoccupied territory. As a result of the demand for territory, a good many disputes arose amongst licensees for each other's territory.

The damage from fire was not great, all the fires reported being confined to the grass lands.

Very little trouble was encountered during 1919 with caiñgin-makers, but complaints were received that many homesteaders have abandoned their homesteads and let them grow up in kogon.

Forty-four parcels of public land were inspected during the year, and there are 290 parcels still pending inspection.

District No. 13; Headquarters, Cebu, Cebu.—The lumber industry has shown very material increase over last year, both in the number of licenses granted and the amount of timber cut. Only first-group woods and some of the hard woods of the inferior groups are being cut, but they find a ready market in Cebu. An exception to this is to be noted around the new coal mines which have been opened up, where they have been using all classes of timber in their development work. There has been very little competition between the lumber companies and licensees, since their products are so different. Prices for all forest products were very high during the year, and conditions in the lumber business, in general, were good. The mangrove swamps are being heavily overcut, but good reproduction has taken place on most of the areas.

THE OFFICE OF THE WOOD EXPERT

No radically new line of work was initiated in this office during the year, but along certain lines the amount of routine work was increased notably, especially in that of checking up the auxiliary invoices.

BOTANICAL AND WOOD COLLECTIONS

Three hundred and seventy-eight botanical specimens were received, of which 217 were accompanied by wood specimens. About one-half of these were collected by the Davao Province reconnaissance party and among these were a number of species not previously represented by wood specimens in our collections. Of the wood specimens without botanical material received during the year, 129 were of sufficient interest to be recorded in the trade sample register. Many of these were received in reply to letters sent out to request specimens of woods recorded in auxiliary invoices under unfamiliar local names.

OTHER ACCESSIONS

One hundred twenty-six phenological reports, containing 305 names, were received and the new names found in them recorded. Eleven new ten foot planks were received and installed and 26 floor specimens (logs), the latter of about 15 species, mostly new to the collection; beside these, a number of new six foot planks were worked up from old material. Also, there were received between 40 and 50 specimens of bamboos, rattans, seeds, basts, and small manufactured or partly manufactured articles of wood or other forest products. One hundred sixty-three numbers were added to the collection of foreign wood specimens, the total in the catalog being now 1855.

HAND SPECIMENS

For the first time in the history of the Bureau, a system was devised and put into practice for supplying every forest station with a complete working set of hand specimens for the use of forest officers, for study and for identification of local timbers. All the old collections existing at various stations were called in and those which were recognizable were relabeled. New sets were prepared, the nucleus being about 100 of the most important and widely known species, which were distributed to all stations. To these were added, for each station, specimens of all the available material from the regions in which the stations are located, which, including often several pieces of one species of distinct character or of different origin, brought the total up to an average of about 180 for each station. These specimens were shipped to the stations in neat cases having hinged doors, to provide a place in each station where the specimens will at once be kept together and be easily accessible. In addition to this, a set of pigeon holes, one for each station, has been prepared in the Manila office, in which new material is distributed as it comes in and is worked up, the resulting additional collections being shipped from time to time to the respective stations. The total number of specimens shipped to the 57 stations outside Manila and Los Baños was over 10,000. The Manila Forest Station has, of course, access to the entire collections in the office and the Los Baños Forest Station to the collections at the Forest School.

Following is the complete record of all hand specimens issued during the year:

Forest Stations	10,370
Forest School (for Class of 1920)	2,530
Sold	1,059
Distributed gratis	4,605
Total	18,564

Those sold and distributed gratis outside of the Islands went, as far as is known, to the following countries: Argentina, Australia, Borneo, China, England, Federated Malay States, France, Holland, India, Japan, Russia, Spain, Sumatra, and the United States.

There were available for distribution, at the end of the year, duplicates of over 300 species.

SHOP WORK

The situation as regards high cost of furniture made in commercial shops has not improved at all; in fact, prices of almost all kinds of furniture in Manila were higher in 1919 than in the previous year, while seasoned lumber is almost unknown in the market. Consequently, the policy of making office furniture in our own shops has been continued and even more work was done along this line than in previous years. The cost of running the shop, as regards wages of workmen, has not increased materially and by selecting fairly well seasoned lumber from the stocks at the Bureau of Supply lumber yards, the work, as regards both quality and cost, is much better than certain pieces of furniture obtained during the year from outside sources. Following is a list of the principal piecies of office furniture and equipment made during the year: Counter before Chief Clerk's and License Clerk's desks; racks for 6 foot planks; 18 typewriter tables; 37 office tables, 3 by 5 and 3 by 6 feet; three flat top desks; 75 hand specimen cases for Forest Stations; four finely finished traveling hand specimen cases for pensionados in the States; 22 drawing boards and 30 T-squares for Forest School; shelving in upper chamber of fireproof vault; 75 chairs for Forest School; about 45 picture frames for Manila office and Forest Stations; 30 Biltmore sticks for Forest School; equipment of three knock-down tables, 3 by 8 feeet, 12 collapsible benches, and 10 packing cases, for Davao reconnaissance party; crates for about 60 specimen cases shipped to stations; about a dozen racks for museum specimens, books, maps, etc.; and minor repair jobs, packing cases, crates, etc., too numerous to classify.

IDENTIFICATION, INSPECTION AND GRADING

Several hundred specimens submitted by forest officers or other Government agents and by private parties were identified, of which, as mentioned above, 129 were considered of sufficient interest for permanent record. An interesting and valuable feature of this work is the identification of wood specimens collected with fungi. Members of the College of Agriculture and of the Bureau of Science who are studying fungi, especially wood-destroying species, submitted during the course of the year several hundred more or less decayed specimens, of which it was possible to identify about 75 per cent, thus establishing the identity of the hosts on which the fungi grew. For railroad companies and sugar estates, 41,243 ties were inspected and identified. Sixty-three long Apitong logs, exported to China by a lumber firm, were inspected for identification. No requests for grading other export lumber were received during the year.

COÖPERATION AND EDUCATION

About 10 exhibits of forest products were made at Arbor Day and Garden Day celebration, in coöperation with the Bureau of Education.

COLLECTING AND RECORDING DATA

The checking up of auxiliary timber invoices, formerly entirely in the hands of the license section, who only consulted this Office occasionally in doubtful cases, was during the early part of the year taken over entirely by this Office. The result has undoubtedly been good both from the point of view of properly collecting the revenue, as also from that of information obtained. The rangers detained to the wood expert's office have a more intimate knowledge of the local names commonly used in the invoices than do the clerks in the license section, thus making errors in identification less frequent, and, in addition to this, whenever an unknown or doubtful name is found in an invoice, a form letter requesting a wood specimen for identification is made out at once and sent to the licensee. Through the replies received, a large number of wood specimens with authentic local names have been added to our collections.

PUBLICATION

The wood expert and his assistants have revised the common names of plants in all the manuscripts of the series of minor forest product bulletins now in course of publication, introducing throughout a uniform system of phonetic spelling which, it is hoped, will be carried out in all future publications, so that, in time, we will have a uniform and consistent standard for spelling all the official and local names.

DIVISION OF INVESTIGATION

This division was handicapped during the year because of the lack of men for research work, besides having to carry on the work of the Forest School in connection with that of the division.

The main activities of the Division of Investigation have been centered along three lines: (1) The preparation and completion of minor forest products bulletins; (2) the writing of a flora of Mount Makiling; and (3) the compiling of a report on reforestation.

MINOR FOREST PRODUCTS BULLETINS

The original idea in the compilation of data on minor forest products was to issue as complete an account as possible of all minor forest products and to have this so arranged and indexed so that it could be consulted either from local names, scientific names or products. As it was impossible to prepare the whole work at one time and as, moreover, the work naturally divided itself under certain distinctive headings, it seemed best to issue first separate bulletins dealing with the several subjects respectively, and afterwards to combine these as sections with additional material and publish as one the complete work. The publishing of the individual bulletins has enabled us to make use of appropriations which were not large enough to cover the expense of the complete volume and to save the type and plates for the preparation of the complete work; also it is believed that this method will result in a considerable saving, since many persons interested in minor forest products will need but one or two of the bulletins of the series. During the year the following minor forest products bulletins were sent to the printer:

BULLETIN No. 18. Philippine Palms and Palm Products.
BULLETIN No. 19. Philippine Fiber Plants.
BULLETIN No. 20. Philippine Resins, Gums, Seed Oils, and Essential Oils.
BULLETIN No. 21. Wild Food Plants of the Philippines.
BULLETIN No. 22. A complete minor forest products bulletin to be issued in two volumes.

THE FLORA OF MOUNT MAKILING

Very satisfactory progress was made during the year on the preparation of a Flora of Mount Makiling, and it is believed that this will soon be ready for publication. This flora will supply a long-felt want in the Forest School, where the students have been handicapped by the lack of a publication which would enable them to identify the woody plants of the region.

REFORESTATION BULLETIN

The Division of Investigation has had work on reforestation under way for a long time, and enough results have been secured to warrant the issuing of a publication on reforestation. This should be very useful alike to the general public, the employees of the Bureau, and to the students of the Forest School. In preparation for this bulletin, all of the trees in the extensive plantations at Los Baños have been numbered and accurately measured, and it is hoped that the coming year will see the completion of this bulletin.

Three and three-fourths hectares were added to the experimental plantations at Los Baños, the site of the Division of

Investigation and Forest School. Another effort was made to reforest the kogon hillside on the Mount Makiling Reservation with Ipil-ipil cuttings and seedlings. The small seedlings of one centimeter in diameter were the only plantings which survived and steps have been taken to reforest the area with the small seedlings, which gave good results in the past year. The areas broadcasted with Ipil-ipil seeds in 1914 are showing good results and the kogon grass (*Imperata exaltata*) is on the wane. The talahib (*Saccharum spontaneum*) has not been affected as yet.

In coöperation with the district forester, a plan has been inaugurated to control caiñgins by requiring the occupant of the land to plant forest trees. The first clearings under the new plan will be made in 1920. During 1919 and even earlier, plantations of Lumbang (*Aleurites moluccana*) were made in the Calamba Estate Addition of the Mount Makiling Reserve, but as these were on agricultural land it was thought best to modify the procedure and require planting to be done upon designated areas rather than upon the land occupied.

The nursery will be transferred during 1920 to a site near the school. There are many seedlings on hand, most of which are required for the reforestation just mentioned.

Total number of seedlings living	18,045
Total number of cuttings living	707

Species planted.—Bagilumbang (*Aleurites trisperma*), Banuyo (*Wallaceodendron celebicum*), Firetree (*Delonix regia*), Kamachile (*Pithecolobium dulce*), Lanutan I (*Bombycidendron vidalianum*), Lumbang (*Aleurites moluccana*), Malaruhat (*Eugenia sp.*), Narra (*Pterocarpus spp.*), Sibukau (*Caesalpinia sappan*), Teak (*Tectona grandis*).

There is a new trail along the Molawin Creek connecting the Foxworthy Arboretum with the Forest School. Another trail has been built from the school to Paliparan. This trail will serve as a patrol trail and eventually will be made a horse trail to Camp Eldridge.

Material was gathered for the repair of the cabin on the summit of Mount Makiling and the work will be completed as soon as possible.

The work for 1920 will consist of laying out a new nursery, inaugurating a complete plantation record, studying growth requirements of different species as shown in the plantation, and rattan studies both at Cavinti and on Mount Makiling.

SILVICULTURE

Nurseries.—The size of the nursery remains the same as was last year. No attempt to enlarge it was made as it is expected soon to abandon it and establish a new one near the Forest School, within the Makiling Forest Reserve. The nursery work was kept up and handled by three men. In December, 1919, there were in the nursery 18,045 seedlings and 707 cuttings.

Plantations.—During the year 1919, 3¾ hectares were added, making the total area of the plantations 83¾ hectares. The cost of upkeep for the year was ₱989.50. The separate items of expense are as follows:

Clearing and cleaning	₱592.70
Cleaning the rides	318.00
Planting	141.80
Total	989.50

Measurement of trees in the plantations.—In order to obtain more definite data on growth, every planted tree in the plantations was tagged and its diameter and height measured. In addition to this, the regular measurement of the best trees of the different species was taken as heretofore.

Growth studies.—The yearly measurement of about 590 trees of Bagtikan, White Lauan, Taluto, Katmon, Guijo, Tamayuan, Duñgon and Camagon, begun in 1913, was continued. Also every tree in the pure stand of Bagtikan near the Forest School was measured. These data, together with that obtained from the plantations, will be published as soon as additional men are secured to relieve the members of the division from the Forest School work. Experiments were started on the determination of the growth of unit areas on Mount Makiling.

Silvical leaflets.—In connection with the class in Silviculture, 21 silvical leaflets, dealing with the species grown in the plantations, were prepared, making the total number of these leaflets 216. These leaflets contain valuable information concerning the species treated.

Reproduction studies.—The reproduction plots in the cut-over areas of the Cadwallader-Gibson Lumber Company in Limay, Bataan, established in 1913, were inspected this year. Data on the growth of certain of the species found in the plots were taken and the results are expected to be published in the near future.

Cost records.—Additional data on the cost records of planting and other work were gathered.

FOREST MANAGEMENT, ENGINEERING AND UTILIZATION

Durability tests.—The work on the durability tests of wood is still in progress, although no additional material was furnished. The tests on bamboos show unquestionably that the preservatives used had no effect toward increasing the durability of the bamboos and it seems probable that no preservative of any kind will ever preserve bamboos in the ground for more than two to three years. The difficulty lies in the impenetrability of the outer, compact, more or less solid and hard layer; the inner layer, though readily impregnable by most preserving materials which might keep it immune, is valueless, for this portion is naturally soft and weak.

Wood preservation.—No work was started in this direction, due to the lack of creosote or any other preservative materials.

THE WORK IN BAGUIO

The working plan for Baguio, the hill station of the Philippine Islands, has been completed, approved, and is now in operation.

NURSERY

The demand for the plants from Nursery was greatly reduced this year, the records showing that only 2,117 plants were given out during 1919. Of this number 590 were taken by private parties, 1,164 plants were used on the parks and roads and 363 plants were given for the Trinidad Agricultural School. The demand from the various gardens was greatly reduced.

There are now available for use 10,000 trees, 15,000 shrubs and shrubby trees and 800 vines, with over 5,000 ornamental and flowering plants.

The planting program of the year 1919, as also for the coming year, was hindered by the scarcity of seed of *Pinus insularis*. From June to September, over 2,000 plants and thinnings from the nursery rows and 957 small trees were set out in the experimental plantation area.

The rains having ceased early during the past year, there was a very serious water shortage, and this had its effect upon the nursery, inasmuch as there was scarcely sufficient water for bathing and culinary purposes, with no water available for sprinkling during the period when the plants were in greatest need of it. In coöperation with the City Engineer, the Bureau planted up quite a few of the stream sources in denuded areas.

Such seeds and plants were ordered from Japan and the United States as in the past had been grown successfully in Baguio. Of the economic species on trial, *Cinnamomum camphora*, the camphor of commerce, has shown excellent results and the Bureau is now taking steps to increase the planting of this species and use it for reforestation purposes. The exotic species which have been successfully established in Baguio are being propagated from cuttings and from imported seeds.

CITY AND PARK IMPROVEMENTS

Spot planting with local pine was started near Military Circle. Paths were laid out, by expert Igorot stone cutters, from the metalled road to the district office, and these stone cutters will be employed for the construction of permanent bridges and culverts in this part of the city in order to do away with the frequent repairs needed where pine lumber has been used in construction.

Improvement thinnings and pruning were begun for securing clean boles and also with the secondary purpose of disposing of the firewood so obtained to the needy residents at cost. Starting this in Forbes Park, it is intended to continue throughout the city and forests.

Turpentine extraction is to be tried on the old trees on Forbes Park, where removal of such trees within the next five years is silviculturally necessary. One new cottage has been constructed in Forbes Park with old material on hand. It was found necessary to reduce the allotment of expenditures for the various projects in the city of Baguio.

To reduce the fire danger the grass was cut in all parks. During the typhoon season, plants on Session Road, the Forest Station and in and around the city of Baguio were pruned and supported. The City Hall, Session Road, Wright Park and the avenues extending to the Mansion House received a substantial addition in ornamental trees and hedges. Burnham Park suffered heavily from the overflowing of the lake and much of the planting was destroyed. A serious fire occurred over the City Cemetery, killing about 130 good-sized saplings and trees.

The working plan has shown that the annual cut of 25,000 cubic meters from the Baguio forests is far too great and that the largest permissible cut should be 16,000 cubic meters if a future lumber and firewood shortage is to be averted. The firewood problem is of increasing importance and the high price of firewood has necessitated a very much more drastic policy along conservation lines, inasmuch as the general public persists in trying to secure cuttings in the immediate neighborhood so as to reduce the outlay for firewood, and very few can understand the reason for not having cheap wood when they see old pine veterans standing on the roadsides or in Forbes Park. Following the suggestion of the Bureau of Forestry officials at Baguio, the firewood licensees have formed an association and meet once a month at the district office of the Bureau. This association has resulted in a better understanding of the aims of the Bureau and in mutual respect between the licensees, and they are coöperating in the detection of forest violations and in fire fighting. Many lot owners have consulted the forestry officers in matters relating to tree felling on their property and such persons have been accorded prompt attention; but cases have arisen where lot owners who cared nothing for the future appearance of the city have cut trees on their property and sold them for firewood. It is impossible for the Bureau to stop this practice and efforts were made to enact an ordinance whereby lot owners desiring to fell pine trees on their property would be compelled to secure permission from the city forester. This ordinance failed of passage on the ground that it curtailed the established rights of property. Some stealing of timber from private property has been the result and complaints were made to the Bureau, but it is, of course, impossible for any of the Bureau of Forestry personnel in Baguio to guard private property.

The demand for Christmas trees, saplings and poles, has also created an undesireable situation, since young trees which the Bureau desired to save, especially along the roads, were cut down by irresponsible visitors and residents for Christmas-tree purposes, even some large Japanese Cedars planted six years ago being cut down for such use, and a policy is now being studied with the object of controlling this evil.

The fire situation in Baguio during the past year has been very bad, due to the dry season, and the possibilities of controlling it are, due to the lack of money, not very encouraging. An automobile truck to carry men and equipment for fighting fire was requested in the appropriation, but denied. It has happened that, where six to eight fires started practically at the same time and no adequate transportation was available, these fires have gained considerable headway with consequent destruction before men arrived on the scene.

THE FOREST SCHOOL

During the year the Forest School was handicapped by lack of equipment and of a full teaching staff, as it was during 1918. The Class of 1919 finished its school work early, the last two months of the term being spent in the field with a party from the Bureau of Forestry. A reconnaissance of the Davao region was made. The graduating class was thus enabled to secure valuable practical training before entering the Bureau of Forestry.

The Chinese graduate made special studies in lumbering before he returned to China.

Two foresters from the school took advantage of the departure of the Senior Class to go on leave to the United States. One returned in June in time for the opening of the school, while the other arrived in September.

One new American forester arrived in the latter part of September and was given charge of the engineering courses, including lumbering.

The Junior Class contained 21 students. Three Chinese students are included in this number. The students are from different sections of the Philippines, but especially from the provinces north of Manila, as may be seen in the following table:

Ambos Camarines	2	Leyte	1
Batangas	1	Pangasinan	10
Bulacan	1	Rizal	1
Cagayan	4	Tarlac	1
Ilocos Norte	3	Union	1
Ilocos Sur	5	Zambales	1
Iloilo	1	China	1
Laguna	1		

A professor from the College of Agriculture was secured to teach the course in Botany during the vacation period, while an instructor from the same College taught trigonometry to the Juniors for the first semester. Arrangements had been made to have the College of Agriculture teach the English courses, but because of the lack of personnel this course was handled by one of the foresters.

It is not feasible to have the students take only one course at the College of Agriculture, unless it is given as the last subject of the day, because of the interference with classes at the Forest School. The two institutions are over a kilometer apart.

The arrival of one new American forester has made it possible to give special work in woodcraft and in connection with military drill. The tying of knots, making hitches and splices, the care and use of saws and axes, first aid and swimming are taught, in addition to the usual military drill.

The courses of study have been rearranged for the purpose of concentrating on essentials and also of securing closer coördination between the several courses.

The proposed higher course in forestry is still in the future, as everything depends upon an appropriation for equipment and additional personnel. It is difficult to secure a man trained in tropical forestry who is willing to come to the Philippines at the salary now offered.

REFORESTATION

The extensive reforestation program which was planned, but which it was impossible to carry out during 1918, was taken up again during 1919 and some headway made.

ILOCOS AND ZAMBALES REFORESTATION

The preliminary work done in the Ilocos Provinces and in Zambales during 1918 was made use of and those municipalities which forwarded resolutions to coöperate with the Bureau of Forestry were again visited and effective work started. In these provinces a total of 11,850 liters of ipil-ipil seeds was distributed for preliminary planting in the kogon areas. Nine cavans (1 cavan=75 liters) of lumbang seeds and eleven cavans of bagilumbang seeds were distributed. Fifteen reforestation demonstration plots were established in as many municipalities, the plots covering an area of about 270 hectares, while the number of nurseries established was two. Of the ipil-ipil seeds distributed, 3,300 liters went to Ilocos Norte, 1,575 to Ilocos Sur and 3,375 to Zambales Province. No lumbang seed was distributed in Ilocos Norte, but 12 cavans of lumbang and bagilumbang seeds were distributed in Ilocos Sur and eight cavans in Zambales Province. Eighty-nine hectares were put into reforestation demonstration plots in Ilocos Norte, 88 hectares in Ilocos Sur and 93 hectares in Zambales. In practically all this work free labor was available. The surrounding population, headed by the teniente del barrio or the councilor of the district, usually did the broadcasting and from seven to twelve cavans of seeds were broadcasted in one day. The average results show that ipil-ipil planted from six months to a year ago is about 20 centimeters in height in all the reforestation plots. The lumbang is 30 centimeters in height and the bagilumbang 35 centimeters in height two months after sprouting. The last two named species are all in the nurseries.

Due to interest taken by the local people in guarding their own plantings, there has been no destruction in any of the plantations. The coöperation of the municipal officials in the fifteen towns above-mentioned is most encouraging, as they were always ready to render help and took considerable pains to explain to the people of their municipalities the purpose of this work and the good effects that would result from the planting. The Bureau has put on a forest guard to patrol these various plots and to keep the Bureau informed as to their condition, while at the same time his presence on the ground helps to keep up the interest already established. One of the nurseries is established on private ground, the use of which was given by Mr. Saturnino Bello, while the other nursery is established on public land. In the nurseries, narra and algarroba (*Ceratonia siliqua*) have been planted for distribution, but the main species are, as stated above, lumbang and bagilumbang. Nurserymen are employed for the care of these two nurseries.

Other municipalities have requested the coöperation of this Bureau and it is hoped that during the coming year the work can be extended to them also. In Zambales Province the work has not been taken up in as detailed a manner as in the Ilocos provinces, but during the coming year more work will be done there insofar as getting coöperation of the municipalities is concerned. Five municipalities in this province have already been taken care of. It is hoped that during next year considerable teak will be planted in Zambales and that enough teak seeds will be available for trials in both of the Ilocos provinces.

ARAYAT REFORESTATION

This project was started in 1914. Due partly to lack of money and men, but principally because of the fact that this project was to be included in a forest reserve and the land question had not been settled, it was not given much attention from a reforestation standpoint. The principal end sought in this project was to provide firewood for the vicinity, inasmuch as the demand for firewood by the sugar mills is very great; one town alone has 64 small mills consuming firewood. As a result of the former activity, approximately 50 hectares are now planted to ipil-ipil. This planting was in patches in the small caiñgins. Over 100 hectares in caiñgins are still to be planted, and the Bureau hopes to effect this during the coming year. Very little coöperation was received from the municipal officials, particularly of Arayat, Pampanga, where during the last election the President issued permits for the cutting of firewood and the making of caiñgins totally without authority from the Bureau of Forestry. Most of the caiñgin-makers were induced to broadcast ipil-ipil seeds in this project during the past year, yet it was found that practically no results were obtained from this work. It is hoped that, should the Arayat Reserve be proclaimed as outlined in last year's report, effective work may be started.

CEBU REFORESTATION

Considerable additions were made to the nursery as far as new species for trial were concerned, but very little work was done during 1919, due to lack of funds, as will be seen from the following comparative table:

Year.	Area under Bureau of Forestry.	Area handled.		Area of kogonal planted.		Area caiñgin planted.		Amount of Ipil-ipil seeds broadcasted.
	Ha.	*Ha.*	*Per cent.*	*Ha.*	*Per cent.*	*Ha.*	*Per cent.*	*Liters.*
1916	Ap. 4,095	666	16.26	352	8.59	52.0	1.27	9,342
1917		971	23.61	854	20.60	67.3	1.65	20,640
1918		1,360	33.24	220	5.41	318.7	7.78	5,280
1919		1.15	.02			1.15	.02	
Total	4,095	2,998.15	73.13	1,426	34.6	439.15	10.72	35,262

Year.	Number of—				Distance boundary.		Distance horse trail constructed.	Distance of foot trail constructed.
	Ipil-ipil seedlings planted.	Lumbang seeds sown.	Bagilum bang sown.	Seedlings set out.	Cleaned.	Planted.		
					Km.	*Km.*	*Km.*	*Km.*
1916	104,841	56,920	163,930		17.2	14.1	.915	3.114
1917	10,628	50,000	245,170	4,136	6.3	6.3	None.	None.
1918	None.	18,000	393,450	7,791	None.	None.	None.	None.
1919	None.	None.	None.	2,880	None.	None.	None.	None.
Total	115,469	124,920	802,550	14,807	23.5	20.4	.915	3.114

Special licenses were issued for the cutting on this project of ipil-ipil for firewood and charcoal, the income from which is turned over to the Bureau of Lands, inasmuch as this land is a part of the Friar lands Estate turned over to the Bureau of Forestry for administration. The following table gives the number of licenses with the amounts requested, purpose for which granted, and the amounts invoiced:

Number of license.	Amount of license.	Product granted.	Amount invoiced.
	Cu. m.		*Cu. m.*
63	100	Firewood	60
64	100	do	45
65	100	Charcoal	27[illegible]
66	100	do	18[illegible]
67	30	do	
68	50	do	
69	70	Firewood	3½
70	50	Charcoal	21[illegible]
71	50	do	34[illegible]
73	Not in file	Firewood	45
76	750	do	145
77	40	do	

Total amount gathered..393⅝ cubic meters.

It is gratifying to know that, after four years, over 393 cubic meters of firewood and charcoal were taken off the area in thinnings from ipil-ipil alone. No serious damage was done in the plantations during the past year and in general the attitude of the people toward this project seems to be much better than in the past, since they have been made to understand what the purpose of this work is, with the result that they now have a better understanding of the law. It is hoped that during the coming year, money will be made available for considerable purchases of seeds and for labor to continue this work.

BAGUIO REFORESTATION

The trials with wild pine seedlings during the past year have given very poor results, which was undoubtedly due to the lack of water during the long dry season of last year. Frequent inspections of the Antamok River Plantation have shown that some 50 per cent of the plants are doing well, with some already flowering, in spite of the fact that cattle are pasturing over the area. Some 360 plants, principally camphor, have been taken to the Trinidad Farm School for reforestation work, and the undersigned wishes to call attention to the public spirit and enthusiastic coöperation of the School Principal, Mr. J. A. Wright, in this work. The Bureau coöperated with the military commander of Camp John Hay, in the planting of the hillside around the hydro-electric plant, where some 60,000 cuttings were set out, the principal object being to prevent slides and erosion. The growth records have been carried on with the local pine, and there are now available continuous records for three years. This work will be continued for at least ten years, or even longer, in order to have reliable data available. Other growth observation plots were located at various points of the forest in and around Baguio.

DIVISION OF SAWMILLS AND UTILIZATION

PERSONNEL

During the past year, one lumber inspector and five rangers assigned to this division have been separated from the Bureau by resignation or dismissal. However, all the members of the new class from the Forest School entering the Bureau this year having received training in scaling work, five of them have been assigned to scaling stations, while the others can be called on, as occasion demands, to perform this class of work.

The plan of training a corps of guard scalers to carry on the actual scaling work under the direction of competent rangers has been continued during the year with the result that the Bureau now has some twelve men of this class stationed at the different mills. Certain guards regularly assigned to other classes of work have had some preliminary training in scaling work, and this makes them available for appointment as guard-scalers, after a short additional training, whenever positions may occur requiring their services.

While in the future thorough training in scaling work will form a regular part of the instruction of rangers studying at the Forest School, the demand for their services in other lines of duty in this Bureau makes it extremely essential that the policy of training guard-scalers for the regular routine work be continued. Accordingly, it is of the highest importance that a sufficient appropriation be provided for giving appointment to these men for duty wherever the quantity of timber cut, (especially by sawmill owners), would require a disproportionate amount of attention from the local rangers.

SCALING

Scaling work at those mills where rangers and guards are regularly stationed (Class C mills) has been generally satisfactory during the year, appreciable difficulties having been encountered at but two mills. These complaints were personally investigated by the chief of this division and by the supervising scaler with the result that in the first case, the complaint of improper identification of species and insufficient deduction for defects, the trouble was found to be largely in a misunderstanding of the mill manager as to the Government system of scaling and lack of familiarity with the species on the part of some of the company's tallymen.

The second complaint arose over the interference with the operations of the logging and transportation work by the time required and place designated for scaling. This case was investigated and trials made at different points to determine the most suitable point which would be satisfactory to both the company and this Bureau.

For scaling at the smaller mills, at which formerly no permanent scaler could be stationed, the work has been greatly improved through the increase in the guard-scaler force, permitting the rangers to make more frequent inspection trips during which they could visit these mills. Moreover, the transfer of rangers trained in scaling work to stations having small mills under their direction, but where formerly none of the rangers were familiar with the work, has helped to improve our supervision of these mills.

LUMBER GRADING

Further work in the training of lumber graders had to be suspended during the past year owing to the demand for utilizing the men for more pressing work and to the resignation of the lumber inspector formerly employed by this Bureau.

The importance of this work (as noted in the annual report of this Bureau for 1917) can not be too greatly stressed, for the interest of all concerned; (1) of the lumberman, on account of the prices he can command for property graded lumber; (2) of the purchaser, through assurance of securing the grade of lumber suitable to his needs; and (3) of the Government, through the better name which such a system is bound to bring to the lumber produced in the Philippines.

At present, almost the only attention paid to grading work by the sawmill companies is that given by a few of the larger companies shipping special stock to foreign markets, or in making up special orders. However, the general attention of all lumber manufacturers and dealers, so necessary to realize the full benefit of this class of work, has not yet been secured; and while the hearty coöperation of lumbermen is essential to the adoption of grading work, it naturally falls on the Bureau of Forestry to do the necessary preliminary work in training a corps of men capable of handling this class of work and demonstrating its full value.

During the past year, several requests have been received and handled, both through the office of the wood expert and the Division of Sawmills and Utilization, for the inspection of lumber shipments. While it is true that these inspections were a start in the right direction, they were made mainly with a view to avoiding shipment of cull lumber which would have had to be thrown out by the purchaser on receipt of the shipment. Moreover, this work was not based on any established rules such as are followed in the United States and other countries, the early adoption of which in this country is greatly to be desired.

Three of the first group of rangers instructed in grading work who have had considerable experience in actual practice have left the Bureau, either temporarily for further study in the United States, or permanently, and the official lumber inspector also has resigned. Nevertheless, the Bureau still has men with more or less training in this work.

UTILIZATION

The efforts on the part of various companies to reduce their waste to a minimum (a matter particularly noted in previous annual reports) have been kept up as much as possible, and some companies have added special units of new machinery for better utilization.

The Insular Lumber Company was forced to close its stave mill for several months, owing to the closing of the Rizal Cement Works and to the overstocking of the China market. However, a new order from Hongkong enabled them to reopen the mill during November. The daily capacity of their present stave mill is from 600 to 800 bundles of 25 staves, or from 4,650 to 6,200 board feet. This material is cut entirely from waste slabs and edgings of the lauans and tangile.

A new source of utilization of waste has been established during the past year by the Oriental Products Company, which concern has established a plant next to the mill of the Negros Philippine Lumber Company where they extract potash from the sawdust and other mill-waste, also from banana and hemp waste. The potash so far extracted has been used in the manufacture of fertilizer, for which the company has had more orders than they have been able to fill.

The Cadwallader-Gibson Lumber Company has during the year added a rotary veneer slicer to their veneer mill, as well as gluing machinery and veneer-ply presses. This company is making numerous experiments with various glues and gluing methods to develop a satisfactory ply-wood from local species. Shipments of sample stock have already been sent to Austrialia and to China, and the Company already has had local orders for plain stock (from the cigar-box and picture-frame trade)—which have necessitated the enlarging of their drying plant.

The manufacture, from otherwise waste material, of short stocks for the United States and China markets is also being continued at this mill, so that the Cadwallader-Gibson Lumber Company secures a very high utilization of their logs.

LUMBERING

Reports from the various mills throughout the Islands show a general increase in lumber production wherever the mills had not previously been running to full capacity, with a resultant increase of 7,000,000 board feet for the period from January 1 to September 30, 1919, as compared with the same peroid in 1918, this increase being in the product of the larger mills from which regular reports are received.

Certain of the mills show some decrease in their production, owing to the fact that time was lost in rebuilding, or in installing new boilers and machinery. The production reports for the periods above mentioned show a total mill tally of fifty-nine and one-half million board feet for 1919, as compared with fifty-two and one-half million board feet for the same period of 1918.

Additions to and improvements of plants are being made by a large number of the lumber companies, while applications for timber licenses from new companies are coming in regularly—all indicating general confidence in a continuation of the present active market, not to mention the apparent expectation of an increasing demand.

Newly formed companies which have been granted long term agreements, either on new areas or for areas abandoned on account of the hard times during the early part of the European war, are: The Zambales Lumber Company, Ruiz y Rementeria, The Olutanga Lumber Company, and the Gordon-Schilling Company; while inquiries and applications have been received for areas in Apayao, Laguna, Tayabas, Mindoro, Samar, Agusan, Zamboanga, and Cotabato.

The Cadwallader-Gibson Lumber Company have at this writing almost completed a new and up-to-date band mill with necessary logging railroad and equipment, on the side of their concession opposite to the site of their present operations and expect to start work there in January, 1920.

Their veneer mill, which is the only one in the Philippines, has been enlarged and improved with a view to handling the increased business which the company is developing in plain veneers and ply-stock.

The Insular Lumber Company, after having taken out its old circular rig, is rebuilding this mill and in it is installing an eight foot band rig, with the intention of increasing the daily output to 100,000 board feet.

They also have done some work in cutting out reverse grades on the railroad and are planning to purchase a heavier type of locomotive and rolling stock to handle the logging work, which has been extended considerably further into the interior of the concession area.

The Negros-Philippine Lumber Company has enlarged and improved the sorting table at the rear of the mill and has installed a 6-foot Mershon roller-band resaw for cutting up cants, which should materially increase their output. They have added a second Shay locomotive—42 tons—on their railroad and are waiting for the arrival of wheels and axles to increase the number of log cars on their railroad. A new logging superintendent has been put in charge, who already has overcome the shortage of log supply at the mill from which the company had suffered since the loss of their former superintendent.

The Kolambugan Lumber and Development Company has, since the arrival of its new manager, doubled its daily output, though still greatly hampered in the increase of its total production through delays in getting new logging equipment from the United States. However, the greater part of this material has now been received, and the operations are going ahead rapidly.

The president of the Mindanao Lumber Company has spent a large amount of time personally supervising the work at Naga-Naga, with the result that the company is now preparing to act on the recommendations of several forest officers that the company install a logging railroad. The president is now looking for men to cruise the company's concession and to survey its railroad line.

The same company owns the Calauag Sawmill and has invested therein extensive improvements and additions to the mill and the logging equipment, which should develop this into an efficient operation during the coming year.

The Port Banga Lumber Company has brought out from the United States a new set of boilers to replace the old ones which were no longer able to supply sufficient power, and the company is rebuilding and improving the arrangement of its mill.

During the past year, the Basilan Lumber Company built, on Maluso Bay, a new mill which started operating about the first of November, and the company is installing a tram line with which to supply logs to its mill.

Various improvements or additions have either been made or prepared for by the Olutanga Lumber Company, Port Lebak Lumber Company, Misamis Sawing Lumber Company and the Catabañgan Sawmill, while the Zambales Lumber Company has installed and started up a temporary circular mill pending the arrival of machinery from the United States for a large band mill and logging equipment. The old Taba Sawmill at Lumarao, Zamboanga, has been purchased from the Bank of the Philippine Islands and will be put in running order within the next few months.

The old Sibuyan Sawmill, which was sold last year, has been moved to and set up on a piece of private forest about four miles from Cadiz, Negros Occidental.

The following table shows a comparative statement of total log scale, trimmer tally and forest charges for the first nine months of 1918 and 1919 from the twelve larger mills operating during these two periods. The figures for these mills give a close indication of the general activity of licensees throughout the Islands.

Totals of the scale, mill tally and charges for 12 sawmills from January 1 to September 30.

Year.	Scale.	Mill tally.	Forest charges.
	Cu. m.	*Cu. m.*	
1919	199,308.11	140,254.66	₱164,024.06
1918	177,699.85	123,982.68	136,825.63

LOCAL MARKETS

The following tables made up from reports received from the ten larger and more regular operators show a comparison of the amounts of lumber shipped to various local ports and to foreign

ports from January 1 to September 30, 1918 and 1919 and for the entire year 1918.

Lumber shipments from January 1 to September 30, 1918, from principal Class B and C sawmills.

Destination.	Red and white Lauan.	Tangile.	Apitong.	Guijo.	Yakal.
Foreign ports	322,976	906,992	----------	----------	----------
Manila	9,227,000	629,744	5,230,967	892,078	986,639
Cebu	248,255	22,846	220,315	127,360	101,153
Iloilo	708,819	----------	58,612	----------	----------
Zamboanga	278,136	----------	128,208	108,191	97,711
Davao	349,113	----------	18,805	38,981	25,524
Mindanao and Sulu	131,687	13,128	27,478	14,888	8,830
Luzon ports	14,717	11,111	38,859	4,586	1,187
Visayan ports	182,565	----------	2,798	----------	----------
Unclassified ports	12,004,408	771,587	1,411,461	54,810	7,898
Total	23,452,126	2,855,408	7,181.998	1,235,839	1,228,987

Destination.	Lumbayau.	Palosapis.	Miscellaneous.	Total.
Foreign ports	----------	----------	----------	1,229,968
Manila	618,166	1,933,363	2,151,342	21,669,284
Cebu	320,853	----------	229,138	1,264,920
Iloilo	----------	----------	150,751	907,682
Zamboanga	367,814	----------	153,084	1,123,094
Davao	1,676	----------	211,859	645,906
Mindanao and Sulu	2,518	----------	184,649	383,128
Luzon ports	----------	573	12,965	83,498
Visayan ports	----------	----------	657,336	842,694
Unclassified ports	123,686	----------	1,075,888	15,449,283
Total	1,434,718	1,933,936	4,826,462	48,599,404

Lumber shipments from Jan. 1, to Dec. 31, 1918.

Destination.	Red and white Lauan.	Tangile.	Apitong.	Guijo.	Yakal.
Foreign ports	322,976	1,089,314	----------	----------	----------
Manila	11,598,489	1,166,034	6,502,318	1,004,798	1,165,025
Cebu	594,498	22,846	400,778	150,584	184,816
Iloilo	958,187	----------	112,895	----------	----------
Zamboanga	642,180	1,345	191,250	196,357	174,431
Davao	425,989	----------	112,018	63,506	25,524
Mindanao and Sulu	166,250	13,275	31,696	15,098	9,356
Luzon ports	14,717	11,412	45,868	4,624	1,225
Visayan ports	214,412	----------	3,540	----------	----------
Unclassified ports	18,687,527	1,121,027	2,258,422	65,269	10,988
Total	33,619,120	3,425,253	9,653,785	1,500,181	1,521,315

Destination.	Lumbayau.	Palosapis.	Miscellaneous.	Total.
Foreign ports	----------	----------	----------	1,412,290
Manila	908,156	2,182,487	2,505,001	27,027,303
Cebu	431,218	----------	251,208	1,985,888
Iloilo	----------	----------	150,751	1,215,823
Zamboanga	468,758	----------	203,879	1,877,660
Davao	49,156	----------	254,191	980,884
Mindanao and Sulu	7,333	----------	271,732	514,740
Luzon ports	----------	573	12,990	91,409
Visayan ports	----------	----------	1,179,983	1,397,985
Unclassified ports	137,531	----------	1,086,060	23,861,774
Total	1,997,152	2,183,060	5,915,290	59,815,156

Lumber shipments from January 1 to September 30, 1919, from principal Class B and C sawmills.

Destination.	Red Lauan and Tangile.	White Lauan.	Apitong.	Guijo.	Manggachapui.
Foreign ports	1,701,187	1,731,772	38,746	----------	----------
Manila	1,937,142	9,531,411	4,609,162	1,500,493	376,142
Luzon ports	2,451	1,650	109,656	1,907	----------
Cebu	550,070	1,321,185	759,367	140,713	43,880
Iloilo	196,352	545,369	102,477	----------	----------
Visayan ports	860,927	139,484	21,648	4,872	----------
Zamboanga	22,436	519,002	203,831	143,754	37,550
Davao	1,395	170,624	37,667	55,049	23,069
Mindanao and Sulu ports	98,823	1,234,103	502,174	116,000	14,986
Unclassified ports	5,978,614	6,777,665	1,512,489	----------	----------
Total	11,349,397	21,972,265	7,897,217	1,962,788	495,627

Destination.	Yakal.	Lumbayau.	Palosapis.	Miscellaneous.	Total.
Foreign ports	----------	----------	----------	41,438	3,513,143
Manila	1,061,675	948,816	572,034	1,652,786	22,189,661
Luzon ports	2,196	----------	475	58,736	177,071
Cebu	158,506	173,460	----------	194,661	3,341,842
Iloilo	----------	----------	----------	----------	844,198
Visayan ports	40,080	15,958	----------	2,583,385	3,666,354
Zamboanga	160,621	435,216	----------	90,232	1,612,642
Davao	50,668	70,083	----------	120,971	529,526
Mindanao and Sulu ports	91,936	276,163	----------	34,674	2,368,859
Unclassified ports	----------	----------	----------	----------	14,268,768
Total	1,565,682	1,919,696	572,509	4,776,883	52,512,064

NOTE.—The above figures are in board feet.

The shipments listed under "Unclassified Ports" were made up almost entirely of the shipments from mills which failed to furnish complete data as to destination of shipments. The major portion of these unclassified shipments were sent to Manila, the remainder going to various local ports in the Visayan Islands, such as Cebu, Iloilo, Bantayan, San Carlos, Bacolod, etc.

The increase in shipments during the past year is indicated by the fact that including the month of October, 1919, the shipments for only the first 10 months of 1919 are 59,737,876 board feet as compared with 59,815,163 for the entire year of 1918. With a maintenance of average monthly shipments from these 10 mills during November and December, the increased shipment of lumber for 1919 will be 100 million board feet, as compared with an estimated total in 1918, from all mills, of 75 million board feet.

Building activities all over the Islands, augmented by the building of new sugar centrals in the Visayas and in Luzon, the development of the coal mines in Mindanao and Cebu, the development of agricultural lands in Mindanao and the general demands of business and housing needs, have greatly increased the call for lumber and made a very favorable year for all lumber producers and dealers.

There is a certain amount of uneasiness expressed among some of the lumbermen that, with the placing of more ships on the Pacific and an expected decrease in freight rates, Oregon Pine will again come into competition with local woods (as it was before the war), at prices which they can not successfully meet. However, the demands which will be made on American timber by the home and European markets, together with the improbability of lumber prices in the United States returning to prewar levels, will doubtless tend to prevent any such serious competition. The investments in machinery for and the development of Philippine lumbering operations already noted in this report indicate that the foregoing is the general feeling among lumbermen in the Islands.

FOREIGN MARKETS

The following table shows the exports of lumber and timber by species from January to September, 1918 and 1919, as reported from the Bureau of Customs. (The exports by countries are not published in monthly statements, but are secured from the Collector of Customs at the close of each year.)

Lumber exports to all countries from January 1 to September 30.

Species.	1919		1918	
	Amount.	Value.	Amount.	Value.
	Cu. m.		*Cu. m.*	
Almon	272	₱8,667	1,642	₱46,997
Apitong	225	12,663	1,806	73,254
Guijo	3	464	12	750
Kalantas	62	3,890		
Ipil	10	2,410	7	909
Lauan	7,530	319,540	2,029	78,762
Molave	1	47	35	5,500
Narra	(?)	150	2	250
Tangile	2,404	166,024	2,310	157,870
Tindalo	1	145	(?)	65
Yakal	4	360	(?)	9
Camagon	5	900	3	114
Manggasinoro	68	2,029		
Tamil	13	378		
Palosapis			443	16,218
Lumbayau			1	41
Other Lumber	6	1,023	1,564	57,898
Nato	17	494	1	163
Total	10,621 [a]4,503,804	519,184	9,855 [a]4,178,520	438,795

[a] Board feet.

Timber exports.

Camagon	18	1,300		
Apitong	42	5,000		
Ipil	1	50	117	9,525
Tangile			81	1,015
Teak	2	300		
Tindalo	1	150		
Total	64 [a]27,136	6,800	148 [a]62,752	10,540

[a] Board feet.

The largest amount of these shipment goes to the United States, with comparatively large shipments to Hongkong and Shanghai, and smaller amounts to Japan, Indo-China, Australia, etc.

Considerable interest has developed in the China market during the past year, several of the lumber companies having sent representatives to investigate market conditions there.

Moreover, a letter was received by this Bureau from Shanghai presenting a short statement of the conditions of the lumber market there and requesting the coöperation of the Bureau of Forestry and Philippine lumbermen in establishing a regular and dependable supply of Philippine lumber. This was taken up with a number of Philippine lumbermen, and a former Chinese student from the Forest School, who had shown unusual ability in the study of logging, milling and marketing work, and who had become well acquainted with the conditions of the Philippine market, was sent to Shanghai to acquaint the Chinese dealers with Philippine timber supply and the market conditions.

While the amount of the bottoms available and the resultant cost of freight have been detrimental to the full development of the China market for Philippine lumber, the interest, so far, of local lumbermen in coöperating with each other in developing that market, has been disappointing.

The great tendency seems to be to want to enter the China market independently, and to make an attempt to "corner" it by making all other companies deal through that one which might first succeed in firmly establishing itself there; and it seems doubtful whether exactly this can be done—not to mention the delay which such a procedure involves for getting Philippine lumber on a solid basis in the China market.

During the year, an Australian lumber dealer visited the Philippine Islands with the object of investigating available supplies of timber and establishing connections.

With such markets available and the world-wide demand there will be for lumber for the next five to ten years for reconstruction work following the war, the possibilities for development of the Philippine lumber industry and for foreign sales are most excellent.

LUMBERMEN'S ASSOCIATION.

The attitude of several of the local lumbermen with regard to the above-mentioned letter from the Shanghai lumber dealers brings up very forcibly the old question of the need for a Philippine Lumbermen's Association. The attempt to organize such a body in 1915 and 1916 had proved a complete failure, owing to the indifference and distrust displayed by the majority of the parties chiefly interested, the lumbermen.

This failure has worked only to disadvantage of the lumber business as a whole in the Islands; and it is therefore very desirable that local lumbermen consider the advantages such organizations in America have brought to manufacturers there, and promptly take steps to overcome their mutual distrust and organize.

Questions of publicity and the development of foreign markets, transportation problems, grading rules, training and appointment of lumber inspectors and all similar matters, could be taken up and settled in a manner which the Bureau of Forestry acting alone could never hope to accomplish. It seems most important for the progress of the lumbering work in this country that anyone who shows a live interest in the matter be aided in any way possible by the Government to revive the idea of organizing a Lumbermen's Association.

DIVISION OF FOREST LANDS AND MAPS.

SECTION OF PUBLIC FOREST LANDS CASES.

The same difficulties encountered in former years have likewise been observed in handling the cases pertaining to the section of public forest lands.

However, one of the difficulties, originating in the interpretation of the Philippine Supreme Court in some of its decisions to the effect that mangrove swamps are agricultural lands, has been dispelled by the last decision handed down by the Supreme Court in the case of J. H. Ankron *vs.* the Government of the Philippine Islands (Official Gazette, Vol. XVII, No. 43, October 22, 1919). In this decision the Court declared that "Whether the particular land is agricultural, forestry, or mineral, is a question to be settled in each particular case, unless the Bureau of Forestry has, under the authority conferred upon it, prior to the intervention of private interests, set aside for forestry or mineral purposes the particular land in question.

"The mere fact that land is a mangrove swamp *is not sufficient in itself* to show that it is agricultural, forestry, or mineral. It may belong to one or the other class."

The following table shows the status of the claims received during 1919:

	Number received.	Action.	No action necessary after inspection.	Pending decision.	Number of hectares adjudicated to the Insular Government.
Cadastral	12	8	---------	8	---------
Ordinary	1,297	134	88	44	154.55
Total	1,309	142	88	52	154.65

SECTION OF PRIVATE FOREST LANDS REGISTRY.

One hundred and ten parcels of land with a total area of 14,943 hectares, 71 ares, and 39 centares have been registered in accordance with the provisions of section 1829 of the Administrative Code, and examined for the information of the Collector of Internal Revenue.

The greater part of the work in this section during the year consisted in preparing the correspondence which required the many claimants of public forest lands to submit their titles for registration in this Bureau; this, because of conflicts and friction between licensees of the Bureau of Forestry and the claimants.

In most cases, no answer to these letters were received from the claimants, and only after making great effort and bringing considerable pressure to bear on the interested parties, was it found that such claims were based either on a private document showing that the rights of a caiñgin maker who abandoned the land had been purchased, or on a mere land-tax declaration, made one or two years previous and covering extensive forest areas. Meanwhile, under such circumstances, the utilization of forest products is necessarily suspended, causing not only a decrease in forest revenues, but also a loss to the licensee in the stoppage of his business during the investigation.

In order as much as possible to obviate these deficiencies and to be able to settle such cases as might arise, suitable legislation was recommended last year which would authorize the Director of Forestry, after making an examination of the land and a careful study of the proofs presented, to settle the questions of fact, which settlement, once approved by the Department Secretary, shall be final so long as the Court of Land Registration, on request by the claimant, might not decide the question. But as no action has been taken regarding this legislation so greatly needed, it is now again recommended, since it is greatly to be desired in the interest of efficient administration.

The following table shows the private woodlands registered up to December 31, 1919:

Registered private woodlands.

Calendar year.	Number of—			
	Parcels.	Hectares.	Ares.	Centares.
1900	420	20,648	68	51
1901	201	68,886	06	95
1902	23	16,412	27	44
1903	3	1,305	94	65
1904	8	29,228	47	82
1905	12	6,631	63	89
1906	21	12,786	95	24
1907	17	28,838	73	05
1908	10	585	97	58
1909	14	6,215	86	62
1910	4	8,658	85	22
1911	5	5,538	67	26
1912	14	6,552	84	89
1913	26	15,229	58	36
1914	16	23,230	05	07
1915	27	13,304	36	95
1916	37	51,668	77	49
1917	48	7,985	68	89
1918	84	48,218	17	26
1919	110	14,943	71	39.24
Total	1,100	380,745	88	98.24

SECTION OF PUBLIC LANDS APPLICATION

The imperative necessity of organizing a large party for the purpose of making a forest reconnaissance of Davao Province, in which all the new graduates from the Forest School at Los Baños took part, under the supervision of old rangers called from the different stations, caused a decrease in the personnel of those stations for field work, with a resultant falling off in public land application examinations. The importance of this work may be seen from the summary given below. This summary is taken from the table showing the distribution of applications for public lands in the different provinces of the Archipelago.

Summary of Table I, Appendix.

Applications on hand during 1919		11,863
Certified for agriculture	5,824	
Certified for forestry	863	7,040
Returned uncertified	353	
Total pending December 31, 1919		4,823

About 46 per cent of the 4,823 pending applications have been examined, but the reports and recommendations of the district officers are pending either because of lack of clerical help or the lack of time to do the work themselves. Furthermore, at the direct requests of applicants who were helped by forest officers in making their applications, 913 parcels of public land have been examined, the certificates of which are ready for issuance as soon as requested by the Director of Lands.

In view of the fact that the new Public Land Act, which changes the procedure of acquiring lands of the public domain, took effect on November 29, 1919, the established method of making examination of lands for certification to the Director of Lands is necessarily affected. Up to the present time, said examination is made, in each individual case, upon request of the applicant, thus compelling the Bureau of Forestry to devote an undue part of its personnel, time and money to his work.

During the past three years the Bureau of Forestry intended to carry out a policy, in connection with the study and location of forest zones and reserves, of examining and certifying large areas for agricultural uses. The lack of personnel, hardly sufficient even for the routine work in forest administration, prevented the carrying out of this project. The new law will necessitate the selection and training of a body of rangers especially for this purpose.

Act 2874 only refers to the intervention of the Bureau of Forestry in cases of leases of public lands (sec. 38) but it is to be expected that on making the recommendation to the Governor-General, as provided in section 6, the Secretary of Agriculture and Natural Resources will order the Bureau of Forestry to demarcate the alienable or disposable zones and likewise the forest zones, according to sections 1827 and 1828 of the Administrative Code.

The demarcation of these zones in each region of the Archipelago is very important for the proper conservation and utilization of large forest resources and their future development and for the setting aside of lands which are really fitted for permanent agricultural uses.

Those forest areas which for one reason or another it is not necessary to keep as such will be certified *en bloc* as alienable lands, so that the Director of Lands may dispose of them in the most convenient way for their proper entry.

The new plan of making the examination and certification of large areas of public lands will indirectly help in solving the important problem of Philippine intermigration. There are regions with dense population where the lack of agricultural lands prevents the extension of agricultural activities and where the destruction of forest wealth is considerable; while other regions with rich agricultural soil, where the forest stand is of very little value and not necessary for conservation purposes, cannot be properly developed because of the present dearth of population.

SECTION OF FOREST ZONES, RESERVES AND COMMUNAL FORESTS

Lamao Forest Reserve.—This reserve was proclaimed on July 26, 1904, by Executive Order No. 33 of that year with the double purpose of making silvicultural studies and experiments and for the establishment of the Forest School. Inasmuch as this latter project was not carried out in this reserve and the silvicultural experiments are only made in the wooded part, it was believed unnecessary to preserve the agricultural portion of the same, and for this reason it was recommended that 890 hectares (the boundaries of which are described in proclamation No. 26 of July 1, 1918) be reverted to public use, and that 621 hectares as a reserve for a horticultural station, in accordance with Executive Order No. 48 of July 12, 1919, be transferred to the Bureau of Agriculture.

Kolambugan Forest Reserve.—Under Executive Order No. 85 of November 12, 1919, the Forest Station Reserve in the concession of the Kolambugan Lumber Co., Barrio Maribojoc, Municipal District of Kolambugan, Province of Lanao, Mindanao Island, was established.

The lack of field personnel and the pressure of other important work prevented the filing of requests for the proclamation of other reserves which are of great importance for conservation ends.

Communal Forests.—In accordance with the provisions of the law, 63 parcels with a total area of 10,537 hectares have been located, studied, and designated as communal forests.

The following tables show the total number of communal forests established up to December 31, 1919, and their distribution by provinces:

Communal Forest established from 1908 to 1919.

Year.	Parcels.	Hectares.
1908	19	5,326.00
1909	19	6,609.00
1910	19	5,796.00
1911	53	15,147.60
1912	59	10,957.00
1913	26	3,887.00
1914	45	6,860.00
1915	90	12,129.00
1916	110	15,862.00
1917	83	10,110.00
1918	61	7,704.82
1919	63	10,537.35
Total	647	110,445.77

Settlement of communal forests established up to December 1919.

Province.	Parcels established.		Total parcels established up to 1919.	Municipalities, rancherias or townships.			Cancelled.	
	Before 1919.	During 1919.		With C. F.	Without C. F.	Area in hectares of parcels established up to 1919.	Parcels.	Hectares.
Abra	21	5	26	14	24	5,472.00		
Albay-Catanduanes	11	1	12	9	13	1,569.00		
Camarines Norte	7	1	8	7	2	1,171.00		
Camarines Sur	28	4	32	22	9	3,877.00		
Antique	4	0	4	3	10	234.00		
Bataan	14	1	15	12	0	4,713.00	2	464.00
Batanes	0	0	0	0	6			
Batangas	1	1	2	1	28	136.00		
Bohol	23	8	31	21	15	3,619.85		
Bulacan	1	1	2	2	22	340.16	1	232.16
Cagayan	33	1	34	18	5	3,559.60		
Capiz	27	0	27	15	10	3,167.00		
Cavite	0	0	0	0	20			
Cebu	10	0	10	7	48	1,175.00		
Ilocos Norte	20	0	20	14	16	6,685.00	4	1,127.00
Ilocos Sur	20	1	21	18	18	7,275.00		
Iloilo	10	0	10	5	25	1,501.00		
Isabela	16	2	18	11	15	2,596.00	1	106.00
Laguna	12	0	12	10	18	1,352.00		
La Union	10	0	10	10	4	3,016.00		
Leyte	30	5	35	18	28	3,719.68		
Mindoro	0	2	2	2	14	584.00		
Misamis	17	3	20	12	88	3,351.00	2	520.00
Mindanao-Sulu:								
Agusan	1	0	1	1	59	160.00		
Bukidnon	1	0	1	1	12	620.00		
Cotabato	0	0	0	0	30			
Davao	0	2	2	1	14	164.00		
Lanao	2	0	2	2	36	800.00		
Sulu	0	0	0	0	27			
Zamboanga	3	0	3	2	75	295.00		
Mountain Province:								
Amburayan	5	1	6	5	4	1,754.00		
Apayao	0	0	0	0	1			
Benguet	1	0	1	1	18	100.00		
Bontoc	0	0	0	0	2			
Ifugao	0	0	0	0	1			
Kalinga	0	0	0	0	1			
Lepanto	1	1	2	1	10	1,225.00		
Negros Occidental	31	1	32	14	11	3,633.00	1	240.00
Negros Oriental	15	1	16	13	84	1,596.00		
Nueva Ecija	22	1	23	21	39	4,954.00		
Nueva Vizcaya	1	1	2	1	18	256.00		
Palawan	0	0	0	0	15			
Pampanga	3	0	3	3	18	395.00		
Pangasinan	31	7	38	26	38	10,887.48		
Rizal	5	1	6	21	4	901.00		
Romblon	6	0	6	4	4	485.00		
Samar	44	3	47	31	14	7,878.00		
Sorsogon-Masbate	16	2	18	12	12	1,807.00		
Surigao	13	0	13	7	7	2,236.00		
Tarlac	10	0	10	7	9	1,849.00	1	265.00
Tayabas-Marinduque	46	3	49	26	6	5,567.00		
Zambales	15	0	15	12	1	3,070.00		
Total	587	60	647	443	948	110,445.77	12	2,954.16

	Parcels.	Hectares.
Total number of parcels and hectares established from 1908 to 1919	647	110,445.77
Total number of parcels and hectares cancelled in various years	12	2,954.16
Balance in force	635	107,491.61

MAPPING AND DRAFTING SECTION

For administrative purposes, there has been completed a new map of Luzon and Mindoro, with the adjacent islands, on a scale of 1:400,000, and considerable progress has been made in the preparation of a map of the Visayan Islands and Mindanao on the same scale. These maps contain all the latest data secured from the Bureaus of Coast and Geodetic Surveys, Lands, Public Works, and other sources, to which there have been added the topographical and forest data secured by this Bureau. The topographical and forest data taken in connection with the forest reconnaissance of Davao have also been compiled and there has been prepared a special map on the scale of 1:200,000 for the report of said reconnaissance.

Topographical and Forest Notes taken during 1919.

District No.	Received.	Pending.	Total.	Forest valuation.
	Kilometers.	*Kilometers.*	*Kilometers.*	*Hectares.*
1	1,712.01	617.55	2,329.56	24.48
2	171.14	90.10	261.24	24.80
3	2.80	28.86	31.66	....
4	309.69	124.61	434.30	285.00
5	669.24	456.82	1,126.06	15.97
6	164.79	335.51	500.30	.88
7	366.58	78.92	445.50	22.00
8	636.60	120.35	756.95	1,221.11
9	281.58	27.93	309.51	5.00
10	239.70	81.58	321.28	2.10
11	309.43	115.49	424.92	11.52
12	76.21	83.67	159.88	16.70
13	311.98	193.96	505.94	14.86
Total	5,301.75	2,305.85	7,607.10	1,644.82

Considerable graphical information has been added to the forest progressive sheets on the scales of 1:100,000 and 1:200,000. In addition, tracings were made from different original plans for communal forests, maps of private lands for registration, models, etc. Three thousand nine hundred and twenty-five (3,925) copies of blue prints were prepared for the public in general and for official purposes.

SECTION OF FOREST RECONNAISSANCE

In view of numerous lease and purchase applications for large areas of public lands in a region where communication is difficult, and which has never been studied, (being almost unknown and regarding which no reliable information was at hand), a party was organized consisting of three forest supervisors, 30 rangers and 30 forest guards. This party, under the supervision of the Chief, Division of Forest Lands and Maps, proceeded from Manila to Davao to carry out, during the months of February to July, the forest reconnaissance of that province.

The discovery, during the course of this reconnaissance, that great areas of commercial forest had been devastated by various corporations which had made applications for public lands, made it necessary to draw away several parties from the work of the reconnaissance to investigate the causes of such destruction, and to measure and assess the value of the timber destroyed.

The liberality and venality of a former forest ranger in Davao caused the Bureau considerable trouble and has created a very bad impression. His reports, embodying recommendations for agricultural purposes, were falsified in many cases, as they covered forest lands of great commercial value. In some cases he granted permits for the destruction of forest upon the mere declaration of the applicants of their intention to lease or purchase a tract of land before approval was had from the head office. This was taken by the companies and corporations as sufficient ground to commence destruction and cultivation either with or without legal permit.

The destroyed timber, which was measured and assessed, amounted to 248,781.18 cubic meters, representing a total of forest charges and surcharges of ₱309,667.03, out of which only ₱73,094.48, corresponding to the destructions which were completely illegal, have been presented for collection by the agents of the Bureau of Internal Revenue.

The results of this forest reconnaissance were prepared in a special report including a map on the scale of 1:200,000 and containing valuable information regarding the topography and the forest importance of this region.

From an agricultural standpoint, the Province of Davao is of great importance, especially the Guianga, Lasang, Tuganay, Tagum, Libuganon, Saug, Limbang, and Hijo valleys.

As regards its forests, from a commercial viewpoint these are not of great value, as only the regions of Guianga and between the Davao and Bunauan Rivers can be logged for local consumption with any likelihood of success, but for purposes of conservation and for the benefit of agriculture itself, the extension of the clearings should be prevented, at least in some regions, since the destruction of the forest will affect unfavorably the supply of water necessary for successful agriculture.

ADMINISTRATIVE DIVISION

On January 1, 1919, the stenographer to the Director, who had first-grade standing and had been in the employ of this Bureau for many years and who had a thorough knowledge of its organization, was appointed Chief Clerk. On his promotion to the latter position, his work as cashier and disbursing officer was turned over to the chief of the disbursing and auditing section of this Bureau, while his work as stenographer was entrusted to a stenographer, formerly an employee of this Bureau, who early in the year was given reinstatement.

RECORDS SECTION

The difficulty of securing an efficient record clerk has not been fully remedied during the year, due to the fact that the salary allowed for this position is comparatively small; however, the efficiency of the record section was not allowed to suffer thereby. The record clerk, appointed in the early part of 1919, was separated from the service and his assistant was placed in charge of the section, but due to the increase in the volume of correspondence requiring to be handled in this section, the chief clerk sometimes has to lend his personal assistance in the work.

During the year, upon due authorization, a fire-proof vault was constructed in the north end of the office building of this Bureau in Manila. This is a valuable addition to the building, as it gives this office a place where its valuable records can be preserved. The transfer of as much as possible of our records to this vault has already taken place. The duplicates of the wood specimens of this Bureau will also be stored there.

GENERAL SERVICE SECTION

The chauffeur, messengers, janitors and watchmen come under the administrative section. The work of these employees has been carried on satisfactorily throughout the year both in the messenger service and the maintenance and upkeep of the building and court yard of this Bureau.

DIVISION OF ACCOUNTS AND PROPERTY

This division, as mentioned just above in this report, was created on January 1, 1919, and the former acting chief clerk, who had been the financial employee of this Bureau for several years and who was thoroughly familiar with all the phases of this work, was appointed chief of this division. With the exception of unusual matters requiring the specific approval of the Director, all routine transactions appertaining to accounts and property are handled entirely in this division.

DISBURSING AND AUDITING SECTION

This section is entrusted with the work of the auditing of traveling expenses, and with such other financial duties in the Bureau as salaries, auditing the expense accounts of Bureau employese and all other bookkeeping work in accordance with the Auditor's regulations. The chief of this section, who is also cashier and disbursing officer of this Bureau, is directly responsible to the Chief of the Division of Accounts and Property. During the year, changes in personnel have occurred in this section also, but the work has been carried on without material impairment of efficiency.

PROPERTY SECTION

The work in the property section also has correspondingly increased during the year. A small old warehouse, just south of the Forestry Building, the property of the Insular Government, which was under the care of the city of Manila, was secured for the use of the Bureau. It is being used for storage of supplies and equipment. In this connection, the undersigned wishes to report that, due to the Bureau having a workshop, (which is under the supervision of the wood expert), office furniture, such as office tables, chairs, portable filing cases, etc., were made in this shop, resulting in economy to this Bureau while giving us office furniture built to our satisfaction.

LIBRARY AND TRANSLATING SECTION

The work of this section has increased considerably due to the number of translations necessary from English to Spanish and *vice versa.* It is a noticeable fact, particularly during the past year, that much more correspondence in Spanish has been received, and it might seem that the English language is not being used to the extent that it should.

Numerous new books, catalogs, trade journals, and forestry literature were received and filed, and this section is gradually working out a system whereby information acquired from various papers, etc., can readily be gotten at. The clerk in charge has been assigned as instructor in Spanish in the Forest School in order to give the forestry students a working knowledge of Spanish before entering the Bureau.

RECOMMENDATIONS

The undersinged wishes to reiterate the recommendations made in last year's report, to wit:

That the illegal occupation of public land be punished by law.

That the illegal cutting of forest products be classed as theft and treated as such.

That section 1520 of the Administrative Code be changed to require the payment of forest charges on all forest products cut or gathered, whether removed from the forest or not, before a license expires.

That efficient means for the eradication of water hyacinth be instituted.

That forest guards be forbidden to have any pecuniary interest in forest products.

That the Bureau of Forestry be given positions for qualified surveyors to do the urgent survey work on forest reserves.

That an attorney of the Bureau of Justice be assigned wholly to the legal work of this Bureau.

That provincial fiscals take more interest in forestry cases, especially in the presentation of evidence.

That the authority of the Bureau of Forestry be increased in order to allow it to decide questions of fact relating to claims of public forests without title, once approved by the Department Secretary.

That a permanent corps of forest guards be organized for administrative and patrol work to substitute the rangers' work and also to relieve rangers for land classification in accordance with the new land law.

That the penalty provided in section 2751 of the Administrative Code be increased and that forest products destroyed be charged at the present market rate and that the punishment be mandatory.

That the surcharges on forest products illegally cut or gathered be trebled in case of the second offense and, in case of third or successive offense, the forest products be seized outright. This is exceedingly necessary to protect legal forest users, to regulate utilization and to avoid the destruction of valuable species necessary for reproduction.

For the Forest School and the Division of Investigation, additional buildings are necessary as well as additional equipment to adequately give the higher course and carry on investigative work. Additional cottages are necessary for the housing of the students and personnel of the School and of the Division of Investigation.

Personnel.—The Government must take action in allowing an increase in clerical personnel as well as in their salaries, and in providing that the salaries of the technical personnel be placed on the same basis as other scientific branches of the Government, and per diems must be raised or it will be practically impossible for the Bureau to function properly and efficiently.

It is further recommended, that game and fish legislation be made stricter and entrusted to forest officers for administration.

Arthur F. Fischer

Director of Forestry.

The SECRETARY OF
AGRICULTURE AND NATURAL RESOURCES,
Manila.

STATISTICAL TABLES

TABLE NO. 1.—*Statement of the public lands applications received from the Bureau of Lands and of the certification made to the same regarding the agricultural or forest value.*

Province.	Received from the Bureau of Lands.									Certification made to the Bureau of Lands.								
	Pending from previous years.				During the year 1919.					Agriculture.				Forestry.				
	A. C.	H.	P.	L.	A. C.	H.	P.	L.	Total.	A. C.	H.	P.	L.	A. C.	H.	P.	L.	Total.
Abra	0	6	2	0	0	13	5	1	27	0	15	6	1	0	2	0	0	24
Agusan	0	84	10	3	0	95	15	7	214	0	108	8	3	0	2	1	2	119
Albay	0	41	6	0	0	199	8	0	254	0	111	3	0	0	25	0	0	139
Ambos Camarines	0	246	14	2	0	282	41	3	588	0	211	16	1	0	68	1	0	297
Antique	0	18	0	0	0	30	2	0	50	0	12	0	0	0	0	0	0	12
Bataan	0	100	18	1	0	79	19	5	222	0	120	21	0	0	3	0	0	144
Batanes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Batangas	0	0	1	0	0	0	6	0	7	0	0	2	0	0	0	0	0	2
Bohol	0	13	1	1	0	25	1	2	43	0	25	0	1	0	0	0	0	26
Bukidnon	0	9	1	1	0	30	2	1	44	0	26	3	1	0	0	0	0	30
Bulacan	0	2	0	0	0	4	0	0	6	0	2	0	0	0	0	0	0	2
Cagayan	0	85	20	0	0	219	32	0	356	0	209	23	0	0	10	0	0	242
Capiz	0	11	2	1	0	10	0	0	24	0	7	1	0	0	0	0	0	8
Cavite	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cebu	0	10	2	0	0	22	10	4	48	0	7	3	0	0	9	6	1	26
Cotabato	0	209	8	9	0	525	16	29	791	0	328	8	19	0	2	0	0	357
Davao	0	271	31	88	0	186	35	69	680	0	159	30	58	0	2	1	10	260
Ilocos Norte	0	10	0	0	0	18	4	0	32	0	21	0	0	0	2	0	0	23
Ilocos Sur	0	59	6	1	0	67	12	0	145	0	91	11	1	0	13	4	0	120
Iloilo	0	14	2	0	0	61	8	1	86	0	62	6	0	0	0	0	0	68
Isabela	0	48	1	0	0	223	28	0	300	0	133	18	0	0	6	0	0	157
Laguna	0	28	1	0	0	25	0	0	54	0	31	1	0	0	2	0	0	34
Lanao	0	30	1	1	0	101	10	1	144	0	63	5	0	0	6	0	0	74
La Union	0	21	3	2	0	36	1	1	64	0	23	1	1	0	0	1	0	26
Leyte	0	149	7	2	0	242	13	1	414	0	156	10	1	0	27	1	1	196
Mindoro	0	379	21	3	0	333	41	5	782	0	276	27	0	0	101	4	0	408
Misamis	0	3	0	0	0	23	1	0	27	0	16	0	0	0	2	0	0	18
Mountain	0	27	3	0	0	55	0	1	86	0	45	0	0	0	4	2	0	51
Negros Occidental	0	94	5	3	0	291	9	4	406	0	137	5	0	0	68	3	2	215
Negros Oriental	0	10	2	0	0	29	1	0	42	0	14	1	0	0	7	1	0	23
Nueva Ecija	0	678	47	25	0	846	104	46	1,741	0	996	75	34	0	87	2	4	1,198
Nueva Vizcaya	0	106	6	2	0	109	10	5	238	0	137	6	2	0	1	0	0	146
Palawan	0	93	1	3	0	111	5	3	216	0	138	1	1	0	5	0	1	146
Pampanga	0	12	2	0	0	60	2	1	77	0	21	0	0	0	1	0	0	22
Pangasinan	0	168	18	1	0	205	37	5	434	0	214	38	3	0	10	4	0	269
Rizal	0	14	2	0	0	36	5	2	59	0	39	6	0	0	1	0	1	47

Romblon	0	17	0	0	0	18	4	0	39	0	2	0	0	0	12	0	0	14
Samar	0	12	1	0	0	41	2	0	56	0	15	0	0	0	3	1	0	19
Sorsogon	0	81	10	0	0	152	17	0	260	0	104	14	0	0	39	3	0	160
Sulu	0	0	0	0	0	2	1	0	3	0	0	0	0	0	0	0	0	0
Surigao	0	9	1	0	0	34	1	0	45	0	10	0	0	0	6	0	0	16
Tarlac	0	215	17	2	0	72	10	1	317	0	210	14	2	0	54	0	0	280
Tayabas	0	635	40	1	0	1,014	67	4	1,761	0	618	39	1	0	188	10	0	856
Zambales	0	51	10	11	0	108	12	1	188	0	88	4	3	0	5	1	0	101
Zamboanga	0	124	11	2	0	313	33	6	494	0	261	25	4	0	17	5	0	312
Total	0	4,182	329	165	0	6,344	635	208	11,863	0	5,256	431	137	0	790	51	22	6,637

TABLE No. 1.—*Statement of the public lands applications received from the Bureau of Lands and of the certification made to the same regarding the agricultural or forest value*—Continued.

Province.	Returned to the Bureau of Lands uncertified during the year 1919.				Total pending for inspection December 31, 1919.				
	H.	P.	L.	Total.	A. C.	H.	P.	L.	Total.
Abra	0	0	0	0	0	2	1	0	3
Aguasan	12	6	0	18	0	62	10	5	77
Albay	0	1	0	1	0	104	10	0	114
Ambos Camarines	18	0	0	18	0	236	38	4	278
Antique	0	0	0	0	0	36	2	0	38
Bataan	12	1	0	13	0	44	15	6	65
Batanes	0	0	0	0	0	0	0	0	0
Batangas	0	0	0	0	0	0	5	0	5
Bohol	0	1	0	1	0	13	1	2	16
Bukidnon	0	0	0	0	0	13	0	1	14
Bulacan	0	0	0	0	0	4	0	0	4
Cagayan	13	2	0	15	0	72	27	0	99
Capiz	0	0	1	1	0	14	1	0	15
Cavite	0	0	0	0	0	0	0	0	0
Cebu	0	0	0	0	0	16	3	3	22
Cotabato	1	1	1	3	0	403	10	18	431
Davao	17	4	24	45	0	279	31	65	375
Ilocos Norte	1	0	0	1	0	4	4	0	8
Ilocos Sur	4	0	0	4	0	13	8	0	21
Iloilo	0	0	0	0	0	13	4	1	18
Isabela	2	1	0	3	0	130	10	0	140
Laguna	5	0	0	5	0	15	0	0	15
Lanao	4	1	0	5	0	58	5	2	65
La Union	1	1	1	3	0	33	1	1	35
Leyte	16	0	1	17	0	192	9	0	201
Mindoro	25	6	0	31	0	310	25	8	343
Misamis	0	1	0	1	0	8	0	0	8
Mountain	1	0	0	1	0	32	1	1	34
Negros Occidental	18	0	0	18	0	162	6	5	173
Negros Oriental	2	0	0	2	0	16	1	0	17
Nueva Ecija	55	1	1	57	0	381	73	32	486
Nueva Vizcaya	5	0	0	5	0	72	10	5	87
Palawan	7	0	2	9	0	54	5	1	60
Pampanga	0	0	0	0	0	50	4	1	55
Pangasinan	6	0	0	6	0	143	13	3	159
Rizal	1	1	0	2	0	9	0	1	10
Romblon	9	0	0	9	0	12	4	0	16
Samar	0	0	0	0	0	85	2	0	87
Sorsogon	8	0	0	8	0	87	10	0	97
Sulu	2	1	0	3	0	0	0	0	0
Surigao	0	1	0	1	0	27	1	0	28

Tarlac	1	0	0	1	0	22	13	1	36
Tayabas	25	2	0	27	0	818	56	4	878
Zambales	9	0	0	9	0	52	17	9	78
Zamboanga	13	5	2	20	0	146	14	2	162
Total	283	87	33	353	0	4,197	445	181	4,823

Fiscal year.	Agricultural colonies.			Homesteads.			Sales.			Leases.			Grand total.
	Agriculture.	Forest.	Total.	Agriculture.	Forest.	Total.	Agriculture.	Forest.	Total.	Agriculture.	Forest.	Total.	
1905	0	0	0	80	6	86	8	0	8	0	0	0	94
1906	0	0	0	318	16	334	20	1	21	1	0	1	356
1907	0	0	0	881	19	900	23	0	23	12	0	12	935
1908	0	0	0	2,456	51	2,507	49	1	50	26	0	26	2,583
1909	0	0	0	1,523	187	1,710	26	3	29	27	0	27	1,766
1910	0	0	0	1,175	385	1,560	34	5	39	42	2	44	1,643
1911	0	0	0	1,528	221	1,749	46	3	49	30	1	31	1,829
1912	0	0	0	2,609	301	2,910	95	11	106	47	1	48	3,064
1913	0	0	0	2,680	269	2,949	104	30	134	47	1	48	3,131
1913 (July 1 to December 31)	0	0	0	1,653	159	1,812	81	16	97	41	3	44	1,953
1914	0	0	0	4,812	685	5,497	279	36	315	77	1	78	5,890
1915	1,086	28	1,114	5,965	688	6,653	317	52	369	70	1	71	8,207
1916	934	41	975	6,015	670	6,685	227	18	245	55	4	59	7,964
1917	670	0	670	7,632	797	8,429	457	27	484	118	6	124	9,707
1918	41	0	41	5,605	621	6,226	420	33	453	109	16	125	6,845
1919	0	0	0	5,256	790	6,046	431	51	482	137	22	159	6,687
Total	2,731	69	2,800	50,188	5,865	56,053	2,617	287	2,904	839	58	897	62,654

SUMMARY.

Applications on hand during 1919		11,863
Certified for Agriculture	5,824	
Certified for Forestry	863	
Returned uncertified	353	
		7,040
Total pending December 31, 1919		4,823

NOTE.—A. C. = Agricultural Colony of 16 hectares lot. H. = Homestead. P. = Purchase. L. = Lease.

TABLE No. 2.—*Statement showing amounts in cubic meters of important timbers, by species cut and invoiced in the Philippine islands during the fiscal years 1910 to 1919.*

Species.	Fiscal year—				July 1 to Dec. 31, 1913.	Fiscal year—						Total 1910 to 1919.
	1910	1911	1912	1913		1914	1915	1916	1917	1918	1919	
Lauan	43,439	46,942	57,086	81,469	20,249	74,453	73,277	107,634	131,699	108,900	180,556	925,654
Apitong	20,764	21,096	28,929	32,891	12,905	32,828	38,849	56,529	55,385	56,274	72,223	423,628
Tangile	2,106	2,762	3,999	5,249	3,390	14,682	15,460	23,961	25,389	21,775	35,005	158,778
Guijo	14,107	14,231	18,579	17,279	7,841	19,701	15,650	16,685	16,857	17,301	25,924	184,155
Yakal	8,225	8,150	14,491	21,770	5,598	15,115	14,714	16,471	11,963	9,162	18,100	143,754
Ipil	13,717	12,296	17,237	15,791	7,535	17,602	12,089	14,147	16,629	15,498	18,926	161,467
Molave	8,923	7,978	9,091	9,863	4,783	9,758	10,546	10,788	13,582	22,233	26,088	133,128
Narra	5,744	4,996	8,474	8,877	3,941	8,467	9,868	7,970	5,904	7,848	11,152	83,241
Kalantas	3,174	1,368	938	3,320	886	2,423	1,999	4,574	7,381	4,975	5,040	36,078
Palosapis						2,222	1,631	2,723	3,042	8,863	15,661	34,142
Manggachapui						1,469	1,859	2,686	2,916	2,214	3,096	14,220
Dungon	2,453	1,098	1,218	931	601	2,199	1,467	1,127	1,592	1,318	1,389	16,433
Tindalo	954	1,018	794	932	484	914	1,181	1,115	1,145	826	1,080	10,443
Akle	809	867	1,295	1,690	729	1,237	1,498	1,088	798	870	987	11,868
Lumbayau									6,085	4,415	4,192	14,692
Pagatpat									1,502	849	2,766	5,117
Other species:												
First group	574	322	707	1,000	687	2,196	2,190	3,074	1,084	1,416	3,385	16,585
Second group	6,667	6,644	7,988	8,548	3,266	9,873	6,940	7,988	6,482	7,779	12,084	83,654
Third group	8,316	10,927	11,796	8,711	2,999	7,557	6,920	5,214	9,896	8,611	58,513	134,459
Fourth group	36,786	41,655	42,981	59,855	25,613	73,017	60,130	56,788	47,661	80,988	3,711	529,080
Total	176,758	182,945	225,548	277,171	101,502	294,758	276,268	341,442	366,891	382,060	495,228	3,120,571

TABLE NO. 3.—*Revenues derived from the sale of forest products and expenditures of the Bureau of Forestry since its organization, April 14, 1900.*

Fiscal year.	Revenue.	Expense.	Surplus.	Expense.
				Per cent.
1901 to 1906	₱2,268,591	₱1,118,887	₱1,149,704	49
1907	191,080	105,050	86,030	55
1908	211,571	107,242	104,329	51
1909	251,380	115,049	136,331	45
1910	271,582	152,161	119,421	56
1911	334,763	160,476	174,287	48
1912	354,685	200,840	153,845	57
1913	390,664	227,048	163,616	59
1913 (July to December 31)	160,913	141,131	19,782	88
1914	442,661	256,990	185,671	58
1915	425,817	274,176	151,641	64
1916	494,447	285,708	208,739	58
1917	536,328	281,126	255,202	53
1918	650,692	334,254	316,438	51
1919	805,229	473,242	331,986	58
Total	7,790,403	4,233,380	3,557,022	54.21

TABLE NO. 4.—*Revenues from sale of forest products January 1 to December 31, 1919.*

Province.	Charges on forest product.								
	Timber.				Firewood.				
	First group ₱2.50 per cubic meter.	Second group ₱1.50 per cubic meter.	Third group ₱1 per cubic meter.	Fourth group ₱0.50 per cubic meter.	Bacauan and tangal ₱0.20 per cubic meter.	Other, 10 centavos per cubic meter.	Minor products.	Lease of forest lands.	Total.
Abra	₱2,184.64	₱1,129.67	₱236.47	₱132.52	₱122.15	₱191.80	₱205.92		₱4,203.17
Agusan	1,498.54	100.93	27.03	44.38	9.04		1,486.07		3,165.99
Albay	4,688.51	4,130.50	3,200.89	1,752.24	770.76	546.69	2,358.50		17,448.09
Ambos Camarines	2,069.66	1,820.32	3,487.51	2,078.39	1,054.79	2,698.32	8,816.52		22,020.51
Antique	577.09	87.80	54.17	109.29		11.50	380.84		1,220.69
Bataan	94.62	2,662.92	9,886.94	5,340.59	682.90	2,879.49	2,488.81		24,036.27
Batanes									
Batangas	1,056.26	410.69	38.53	205.12	115.40	1,668.95	4,928.29		8,423.24
Bohol	661.99	119.89	238.14	556.44	1,396.10	739.55	471.89		4,184.00
Bukidnon	114.30	23.66	5.01				61.15		204.12
Bulacan	1,578.81	1,516.99	2,291.89	3,078.99	85.27	204.95	1,441.86		10,198.76
Cagayan	20,190.23	1,702.68	4,066.35	554.87	141.54	395.61	4,945.82		31,997.10
Capiz	478.58	203.94	1,539.28	1,021.52	2,597.17	1,198.01	1,608.74		8,642.24
Cavite				10.29		336.28	660.08		1,006.65
Cebu	1,624.14	471.63	908.68	969.78	3,161.19	1,709.97	857.96		9,698.35
Cotabato	8,419.50	5,075.49	1,628.29	3,311.85	27.56	76.40	3,570.07		22,109.16
Davao	1,800.96	258.50	187.90	627.28	233.33	209.32	1,740.04		5,057.33
Ilocos Norte	734.67	616.15	176.21	140.23	42.60	120.55	258.01		2,088.42
Ilocos Sur	98.82	45.08	19.62	28.24	.80	62.80	637.58		892.94
Iloilo	1,368.88	762.65	1,412.98	804.01	2,126.17	2,202.52	8,340.80		17,018.01
Isabela	8,333.22	2,253.63	1,138.59	641.54	46.34	165.09	182.72		12,761.13
Laguna	172.75	900.91	1,786.25	1,267.13	4.34	1,035.69	1,287.81		6,454.88
Lanao	52.51	83.31	115.06	120.27	2.00	26.98	155.58		555.71
La Union	267.78	162.56	91.46	16.82	.32	1.68	223.98		764.55
Leyte	4,470.71	1,325.42	3,601.58	3,162.68	1,451.62	58.01	2,948.78		17,018.75
Manila	76,224.45	14,558.46	94,600.71	53,460.52	1,439.48	2,923.96	9,526.38	₱104.50	252,838.46
Mindoro	4,566.74	2,639.08	746.78	1,148.36	870.31	915.66	4,168.06		15,054.99
Misamis	1,225.71	388.17	1,873.68	817.34	60.18	53.12	1,042.24		5,460.44
Mountain	1,321.75	444.83	6,565.45	938.12	18.59	1,567.21	654.76		11,510.71
Negros Occidental	9,089.38	2,131.52	3,221.27	4,002.82	1,718.98	1,349.00	6,097.75		27,605.67
Negros Oriental	1,896.15	841.42	855.15	198.09	7.20	107.48	4,884.02		8,234.51
Nueva Ecija	1,966.28	988.22	76.89	127.38		166.36	2,868.62		5,658.75
Nueva Vizcaya	357.14	17.43	7.18	15.60		23.50	67.12		487.97
Palawan	2,138.55	60.99	43.24	105.89	134.78	140.27	3,218.98		5,837.70
Pampanga	221.51	398.65	810.00	406.84	108.20	637.98	764.63		3,342.81
Pangasinan	3,726.71	2,881.49	3,578.65	676.29	1,402.19	845.00	1,172.48		14,282.81
Rizal	206.37	188.70	55.79	851.76	6.00	1,769.02	2,004.82		5,082.46
Romblon	273.26	144.96	285.69	147.56	37.28	31.29	647.29		1,567.33

Samar	2,236.43	963.09	1,639.81	797.43	420.74	74.01	4,303.78		10,435.29
Sorsogon	11,523.63	2,846.08	1,799.86	4,023.78	1,638.99	766.59	3,750.08		26,349.01
Sulu	8,442.54	1,284.07	245.31	955.15	355.67	96.83	166.94		11,546.51
Surigao	556.88	258.00	332.74	134.71	428.01	15.10	2,803.02		4,528.46
Tarlac	404.48	166.20	23.59	133.93		210.68	1,208.49		2,147.37
Tayabas	60,540.35	3,770.03	4,137.73	2,195.87	6,144.50	7,591.45	18,570.61		102,950.54
Zambales	1,159.83	1,317.07	3,739.03	692.59	288.90	329.99	3,168.83		10,696.24
Zamboanga	9,608.43	6,351.31	14,991.45	10,533.12	1,164.30	185.63	5,612.40		48,446.64
Total charges	239,529.77	64,103.89	167,635.26	99,279.68	27,522.25	31,127.65	112,358.00	104.50	741,661.00
Total fines and penalties	20,763.97	4,851.20	7,128.57	9,057.44	2,778.44	5,207.64	13,780.47		63,567.73
Grand total	260,293.74	68,955.09	174,763.83	108,337.12	30,300.69	36,335.29	126,138.47	104.50	805,228.73

TABLE NO. 5.—*Timber licenses in force during fiscal year 1919 (January 1 to December 31).*

Province.	Timber licenses.					Gratuitous licenses.				Total.
	For less than 100 cubic meters.	For 100 cubic meters and less than 1,000 cubic meters.	For 1,000 cubic meters and over.	Licenses agreements.	Total commercial licenses.	For personal use.		For public works.	Miner's gratuitous licenses.	
						Inside communal forests.	Outside communal forests.			
Abra	50	59	-----	-----	109	9	5	3	-----	17
Albay	8	30	14	-----	52	20	36	1	1	58
Ambos Camarines	26	74	8	1	109	2	11	22	20	55
Antique	8	4	-----	-----	12	-----	-----	1	-----	1
Bataan	56	37	28	2	123	-----	2	4	-----	6
Batanes	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Batangas	8	13	2	-----	23	1	1	-----	-----	2
Bohol	23	11	-----	-----	34	10	32	10	-----	52
Bulacan	3	56	4	-----	63	-----	3	5	8	16
Cagayan	5	125	7	-----	137	47	6	14	3	70
Capiz	39	58	3	-----	100	14	2	7	-----	23
Cavite	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Cebu	24	14	2	-----	40	6	15	2	2	25
Ilocos Norte	31	30	4	-----	65	18	-----	11	-----	29
Ilocos Sur	21	-----	-----	-----	21	18	-----	5	-----	18
Iloilo	14	34	2	-----	50	-----	1	1	-----	2
Isabela	52	36	1	-----	89	21	-----	8	-----	29
Laguna	37	48	4	-----	89	-----	17	5	-----	22
La Union	2	7	-----	-----	9	23	-----	1	-----	24
Leyte	53	96	8	-----	157	29	109	9	-----	147
Mindoro	17	71	18	-----	106	-----	8	1	-----	9
Misamis	16	10	2	-----	28	5	25	2	-----	32
Department of Mindanao and Sulu:										
Agusan	5	11	3	-----	19	16	83	2	1	102
Bukidnon	-----	2	1	-----	3	-----	1	-----	-----	1
Cotabato	2	3	5	-----	10	-----	1	1	-----	2
Davao	41	37	4	-----	82	-----	12	4	-----	16
Lanao	5	1	2	1	9	-----	-----	3	-----	3
Sulu	-----	3	9	-----	12	-----	-----	1	-----	1
Zamboanga	37	28	22	4	91	9	41	5	-----	55
Mountain Province	119	32	13	2	166	2	3	15	8	28
Nueva Ecija	13	36	7	-----	56	9	3	4	-----	16
Nueva Vizcaya	15	1	-----	-----	16	1	8	1	-----	10
Occidental Negros	11	57	14	2	84	2	1	2	-----	5
Oriental Negros	5	15	2	-----	22	4	5	5	-----	14
Palawan	17	6	42	-----	65	-----	18	4	2	24
Pampanga	3	16	3	-----	22	-----	-----	3	-----	3
Pangasinan	29	91	1	-----	121	31	4	8	-----	43
Rizal	8	26	-----	-----	34	-----	3	-----	-----	3
Romblon	10	9	2	-----	21	8	11	2	-----	21
Samar	72	75	10	-----	157	137	23	5	-----	165
Sorsogon	74	75	6	-----	155	1	35	5	13	54
Surigao	54	4	5	-----	63	13	62	4	1	80
Tarlac	5	14	1	-----	20	50	12	1	-----	63
Tayabas	44	157	42	1	244	24	4	7	3	38
Zambales	16	31	14	1	62	22	2	5	1	30
All provinces	-----	-----	-----	-----	-----	-----	-----	1	-----	1
Total	1,078	1,548	315	14	2,950	547	605	200	63	1,415

NOTE.—In Cagayan, Isabela, Nueva Vizcaya, La Union, Abra, Mountain Province, Ilocos Sur, Pangasinan, Nueva Ecija, and Tarlac, 1,009 licenses were issued for building tobacco curing houses.

TABLE NO. 6-*a*.—*Report of utilization of forest products from public forests of the Philippine Islands during the fiscal year 1919 (January 1 to December 31).*

Province.	Timber.					Firewood class.		Charcoal.	Dyewood.	Tanbark.	Dyebark.
	Group.				Total.						
	First.	Second.	Third.	Fourth.		First.	Second.				
	Cu. m.	*Cu. m.*	*Cu. m.*	*Cu. m.*		*Cu. m.*	*Cu. m.*	*Cu. m.*	*Kilos.*	*Kilos.*	*Kilos.*
Abra	728	692	242	244	1,906	13	2,837			8,750	
Albay	1,759	2,716	2,598	2,126	9,199	3,658	1,878			5,874	
Ambos Camrines	508	918	7,625	5,899	14,945	7,689	23,337			127,130	
Antique	180	21	32	69	302					5,334	
Bataan	31	3,153	30,270	28,200	61,654	2,519	26,540	657		3,720	
Batangas	156	13	3	18	190		20,501	235		359,900	
Bohol	166	71	244	966	1,447	18,402	12,280			5,582	170
Bulacan	325	707	1,392	3,097	5,521	1,046	1,868	438		11,656	
Cagayan	7,323	683	3,286	746	12,038	479	2,863			11,541	
Capiz	80	138	1,306	1,102	2,626	12,963	11,156	218		5,552	3,362
Cavite		3		8	11		3,434	14		30,436	
Cebu	111	59	102	284	556	188	10,537	87		5,096	86
Ilocos Norte	257	328	157	184	926	29	658			27,468	1,600
Ilocos Sur	17	11	12	19	59		234			75,577	
Iloilo	70	94	202	341	707	7,645	21,489	269	1,778,828	211,816	
Isabela	2,475	1,413	1,009	698	5,595		669				
Laguna	15	402	1,575	1,696	3,688	118	8,507	1,331		24,708	
La Union	92	132	61	41	326	1	20			15,444	
Leyte	1,710	733	2,764	4,080	9,287	5,421	873	11		160	
Mindanao and Sulu:											
1. Agusan	725	62	3	9	799	205	30				
2. Bukidnon	17			23	40						
3. Cotabato	5,315	4,143	2,127	4,779	16,364	163	432				
4. Davao	424	94	121	309	948	1,117	337	22			
5. Lanao	756	439	26,585	14,308	42,088		339				
6. Sulu	2,008	1,013	313	812	4,146	1,121	1	85		15,650	
7. Zamboanga	5,107	6,640	15,881	34,412	62,040	4,170	1,249	144		278,603	380
Mindoro	3,146	5,682	1,803	1,983	12,614	8,060	11,882	16		182,030	20,792
Misamis	256	420	666	1,038	2,380	361	1,142			1,460	
Mountain Province	1,070	280	3,261	2,929	7,540		14,759	85		1,606	
Negros Occidental	2,668	1,225	62,944	46,827	113,664	11,627	8,080	15		352	
Negros Oriental	521	564	421	409	1,915	53	1,054			3,646	
Nueva Ecija	548	327	81	219	1,175		2,027	14		14,152	
Nueva Vizcaya	116	4	7	2	129		213				
Palawan	17,946	1,466	69	209	19,690	312	282			99,207	22,270
Pampanga	95	366	689	635	1,785	280	2,130	356		1,600	
Pangasinan	1,442	1,682	2,563	1,038	6,725	7,151	3,597	68	16,256	100,622	2,010
Rizal	26	84	46	930	1,086	4	1,760	677	200	14,939	1,000

TABLE NO. 6-*a*.—*Report of utilization of forest products from public forests of the Philippine Islands during the fiscal year 1919 (January 1 to December 31)*—Continued.

Province.	Timber.					Firewood class.		Charcoal.	Dyewood.	Tanbark.	Dyebark.
	Group.				Total.						
	First.	Second.	Third.	Fourth.		First.	Second.				
	Cu. m.	*Cu. m.*	*Cu. m.*	*Cu. m.*		*Cu. m.*	*Cu. m.*	*Cu. m.*	*Kilos.*	*Kilos.*	*Kilos.*
Romblon	118	108	118	58	397	59	200				
Samar	1,018	501	1,638	1,289	4,441	3,021	234			30,688	
Sorsogon	4,996	2,231	1,265	5,830	14,322	5,378	5,728	26		50,562	1,840
Surigao	174	145	638	53	1,010	1,160	70	10		18,383	
Tarlac	183	81	46	75	385		1,409	23		12,724	
Tayabas	19,545	2,410	17,535	3,776	43,266	32,270	43,302	439		41,737	11,356
Zambales	445	694	3,188	1,019	5,346	1,976	2,028	124			
Total	84,658	42,943	194,838	172,789	495,228	138,649	251,856	5,264	1,794,784	1,780,705	64,866

Province.	Wood-oils.	Copal (Almaciga).	Gutta-percha.	Split rattan.	Unsplit rattan.		Diliman.	Stone.	Lime stone.	Gogo.	Daluru.	Buri.
					Over 2 centimeters diameter.	Two cm. diameter or less.						
	Liters.	*Kilos.*	*Kilos.*	*Kilos.*	*Lin. m.*	*Lin. m.*	*Kilos.*	*Kilos.*	*Kilos.*	*Kilos.*	*Cu. m.*	*Kilos.*
Abra				80	60,000	277,200			8,000			
Albay				54,544		4,000						
Ambos Camarines		136,676		578,610	10,480	681,600	1,720	202	20,945	1,100		
Antique				8,659			3,786					6
Bataan				75,251	131,015	256,800	2,517			1,176		
Batangas				186						44,808		
Bohol	285	360		50						98		
Bulacan				13,595	105,070	1,030,898				186		
Cagayan		9,507		209,495	121,116	78,132						
Capiz				3,912			100			20		906
Cavite				300						4,344		
Cebu	40			2,480						237		
Ilocos Norte				892					10,532			
Ilocos Sur								115,355	124,685	282		
Iloilo				8,011			4,400					
Isabela					88,000	189,660						
Laguna				14,479	4,627	470	7,206			484		
La Union												
Leyte	33,400			23,680	75,108	98,949	10,590	584		114		

Mindanao and Sulu:												
1. Agusan				124,806	809	93,352	176					
2. Bukidnon				12,706	250							
3. Cotabato		425	17,405	2,222								
4. Davao		438,870		1,080		31,750						
5. Lanao			809	527			550					
6. Sulu				909								
7. Zamboanga		932	2,756	28,200	6,050	59,750				32		
Mindoro				92,867	7,500	126,819	53,416			4,252	40	3,455
Misamis			223	24,299		1,000	445					
Mountain Province				110,952	16,840	45,000		1,801	124,000			
Negros Occidental	22,271			361,888	11,000	30,806	5,227			3,977		
Negros Oriental	21,052	10,256		210,725	54,713	9,100	1,720			4,070		
Nueva Ecija				52,236	160,812	147,377				19,601		19,375
Nueva Vizcaya												
Palawan	530	49,704		11,558		1,092,117				5,633		
Pampanga				1,875	4,180	2,500	1,900			979	205	10,734
Pangasinan					4,000	14,152					38	573
Rizal				44,702	4,800	4,650				1,043		
Romblon	14,907	14,250		5,471		6,750						
Samar	7,064			154,570	7,704	6,102	9,270			10		
Sorsogon	8,938	494		200,561			3,839			265		63
Surigao	1,050			176,022	830							
Tarlac				40,094	1,120	67,360	10			14,092		
Tayabas		431,349		875,913	1,569,260	7,457,587	14,329	418		80		4,834
Zambales				87,129	160,450	8,444,906				23,804		
Total	109,536	1,092,823	20,693	3,059,936	2,550,229	15,248,237	120,700	118,290	288,112	130,127	283	39,946

TABLE NO. 6–*b*.—*Statement of forest products, cut or gathered from registered private woodlands during fiscal year 1919.*

Province.	Timber.					Fire-wood.	Char-coal.	Tan-bark.	Gogo.	Dye-bark.	Split rattan.	Dili-man.	White earth balls.	Daluru.
	First group.	Second group.	Third group.	Fourth group.	Total.									
	Cu. m.	*Cu. m.*	*Cu. m.*	*Cu. m.*	*Cu. m.*	*Cu. m.*	*Cu. m.*	*Kilos.*	*Kilos.*	*Kilos.*	*Kilos.*	*Kilos.*	*Cu. m.*	*Cu. m.*
Albay		77	38		115									
Ambos Camarines						20								
Bataan			128	8	136	2,753	16					2,389		
Batangas	15	128	24	13	180	1,826		210,675		10,500				
Bulacan						3,708	15	1,027						
Capiz						433								
Cavite						5,462	196	2,200	28					
Ilocos Norte	414	287	668		1,369									
Iloilo						152								
Laguna		9	14	14	37	5,595	6,839	2,502					17,437	
Mindoro	17	11		38	66									
Negros Occidental	122	350	1,574	2,666	4,712	2,253								
Nueva Ecija	42	103			145	128			3,345		12,660			
Pampanga		1		59	60	19,085	2,871							48
Rizal	73	4	1	17	95	6,882	81					35		
Tarlac	52	5	1	29	87	15,070	954							
Total	735	975	2,448	2,844	7,002	68,862	10,972	216,404	3,373	10,500	12,660	2,424	17,437	48

TABLE NO. 7.—*Minor product licenses in force during fiscal year 1919 (January 1 to December 31).*

Province.	Firewood.	Charcoal.	Dyewood.	Tanbarks and dye bark.	Wood oils.	Almaciga resins and others.	Gutta-percha.	Bejuco and diliman.	Gogo.	Others.	Total.
Abra	25	------	------	1	------	1	------	21	------	3	51
Albay	55	------	------	7	------	------	------	54	------	2	118
Ambos Camarines	100	2	------	17	------	23	------	212	4	7	365
Antique	7	------	------	1	------	------	------	33	------	2	43
Bataan	57	14	------	3	------	6	------	94	25	------	199
Batanes	------	------	------	------	------	------	------	------	------	------	------
Batangas	18	------	------	4	------	3	------	------	------	7	32
Bohol	27	------	------	2	------	------	------	------	------	------	29
Bulacan	6	14	------	------	------	4	1	35	8	------	68
Cagayan	47	1	------	3	1	38	------	122	1	1	214
Capiz	58	2	------	4	2	1	------	31	1	2	101
Cavite	8	------	------	------	------	------	------	3	2	------	13
Cebu	50	18	------	2	------	------	------	7	------	------	77
Ilocos Norte	17	------	------	1	------	------	------	6	------	4	28
Ilocos Sur	10	1	------	5	------	1	------	------	------	23	40
Iloilo	70	9	25	20	1	4	------	19	1	12	161
Isabela	29	------	------	------	------	6	------	36	------	------	71
Laguna	19	8	------	1	1	3	------	19	5	22	78
La Union	4	1	------	1	------	------	------	------	1	------	7
Leyte	60	2	2	4	4	2	------	56	------	48	178
Mindoro	75	5	------	50	------	2	------	95	33	2	262
Misamis	14	------	1	2	1	1	1	23	1	2	46
Department of Mindanao and Sulu:											
Agusan	5	------	------	------	------	------	------	45	------	2	52
Bukidnon	------	------	------	------	------	------	------	20	------	------	20
Cotabato	8	------	1	------	8	4	10	10	------	13	54
Davao	58	12	1	1	1	14	1	22	------	2	112
Lanao	14	1	1	3	------	1	2	10	1	2	35
Sulu	8	------	1	6	1	1	1	1	1	2	22
Zamboanga	84	5	1	26	1	11	12	70	1	2	213
Mountain Province	36	1	------	1	------	5	------	58	------	3	104
Nueva Ecija	26	4	------	4	------	2	------	59	56	12	163
Nueva Vizcaya	6	------	1	------	------	------	------	1	------	------	8
Occidental Negros	92	1	------	8	31	8	------	312	48	19	519
Oriental Negros	13	------	------	------	1	------	------	70	11	15	110
Palawan	61	------	------	56	3	29	------	48	13	------	210
Pampanga	9	8	------	------	------	------	------	10	2	3	32
Pangasinan	65	6	4	11	------	2	------	8	4	2	102
Rizal	30	16	2	5	------	2	------	24	12	3	94
Romblon	7	------	------	1	4	8	------	5	1	1	27
Samar	48	1	------	4	5	1	------	86	------	2	147
Sorsogon	88	6	4	11	3	2	------	93	6	2	215
Surigao	29	3	------	7	1	1	------	27	1	11	80
Tarlac	13	4	------	2	------	1	------	12	8	2	42
Tayabas	150	14	------	56	1	70	------	146	24	25	486
Zambales	59	12	------	6	1	6	------	52	20	------	156
Total	1,665	171	44	336	71	263	28	2,055	291	255	5,179

TABLE NO. 8.—*Statement showing the quantity and value of minor forest products exported during the fiscal year 1919 (January 1 to December 31).*

	Kilos.	Value.
Copal (almaciga):		
United States	120,523	₱40,797
United Kingdom	215,333	55,659
Belgium	5,692	1,800
France	5,800	1,507
Spain	11,240	5,800
China	843	450
British East Indies	492,183	75,952
Australasia	4,064	1,321
Total	855,678	183,286
Elemi (pili resin):		
United States	188,309	130,981
United Kingdom	37,981	24,262
Belgium	337	320
Spain	360	238
Total	226,987	155,801
Gutta-percha:		
United States	4,497	3,500
British East Indies	33,583	33,442
Total	38,080	36,942
Rubber:		
United States	86,134	139,971
Hongkong	589	76
Japan	80	20
Total	86,803	140,067
Lumbang (candle nut) oil:		
United States	138,620	92,843
Sappan wood (sibukau):		
China	1,484,684	72,989
Hongkong	757,820	38,495
Total	2,242,504	111,484
Total		720,423

TABLE NO. 9.—*Statement of appropriation and expenditures, Bureau of Forestry (January 1 to December 31, 1919).*

Appropriation:		
Act No. 2785		₱505,650
Expenditures:		
Salaries and wages	₱279,450.01	
Bonus	53,918.85	
Furniture and equipment	13,915.94	
Traveling expenses of personnel	51,204.26	
Rentals of buildings and grounds	6,060.42	
Freight, express, and delivery service	2,926.59	
Printing and binding reports, documents and publications	5,000.00	
Postal, telegraph, and cable service	5,091.20	
Illumination and power service	2,258.02	
Plant and equipment repair service	1,172.39	
Contingent service	1,999.08	
Consumption of supplies and materials	34,490.16	
Travel expense of persons not Government employees	377.44	
Total expenditures		457,854.36
Balance January 1, 1920		47,795.64
Appropriation for Cebu reforestation (Act No. 2649) Balance January 1, 1919		995.27
Expenditures:		
Salaries and wages	499.01	
Traveling expenses of personnel	257.82	
Rentals of buildings and grounds	3.50	
Freight, express, and delivery service	124.85	
Postal, telegraph, and cable service	9.56	
Consumption of supplies and materials	7.33	
Travel expense of persons not Government employees	1.00	
Total expenditures		902.57
Balance January 1, 1920		92.70
Appropriation for Davao forest reconnaissance (Act No. 2859)		15,000.00
Expenditures:		
Furniture and equipment	1,057.38	
Traveling expenses of personnel	9,723.30	
Rentals of buildings and grounds	10.00	
Freight, express, and delivery service	77.62	
Postal, telegraph, and cable service	74.48	
Contingent service	36.50	
Consumption of supplies and materials	3,506.16	
Total expenditures		14,485.44
Balance January 1, 1920		514.56
Appropriation for construction of six forest stations (Act No. 2786).		
Balance January 1, 1919		3,517.24
Expenditures		3,509.15
Balance January 1, 1920		8.09
Appropriation for construction of road, Los Baños (Act No. 2786).		
Balance January 1, 1919		7,989.19
Expenditures		7,989.18
Balance January 1, 1920		.01
Appropriation for construction of a fire-proof vault (Act No. 2786)		15,000.00
Expenditures		12,692.81
Balance January 1, 1920		2,307.19
Appropriation for construction of three forest stations (Act No. 2786)		5,000.00
Balance January 1, 1920		5,000.00
Appropriation for installation of an electric lighting system, Los Baños (Act No. 2786)		6,000.00
Balance January 1, 1920		6,000.00
Statement of Bureau of Forestry appropriations, expenditures and revenues for fiscal year 1919:		
Appropriations		521,645.27
Revenue		805,228.73
Expenditures		473,242.37
Surplus		331,896.36
Percentage of expenditures to revenue		.58

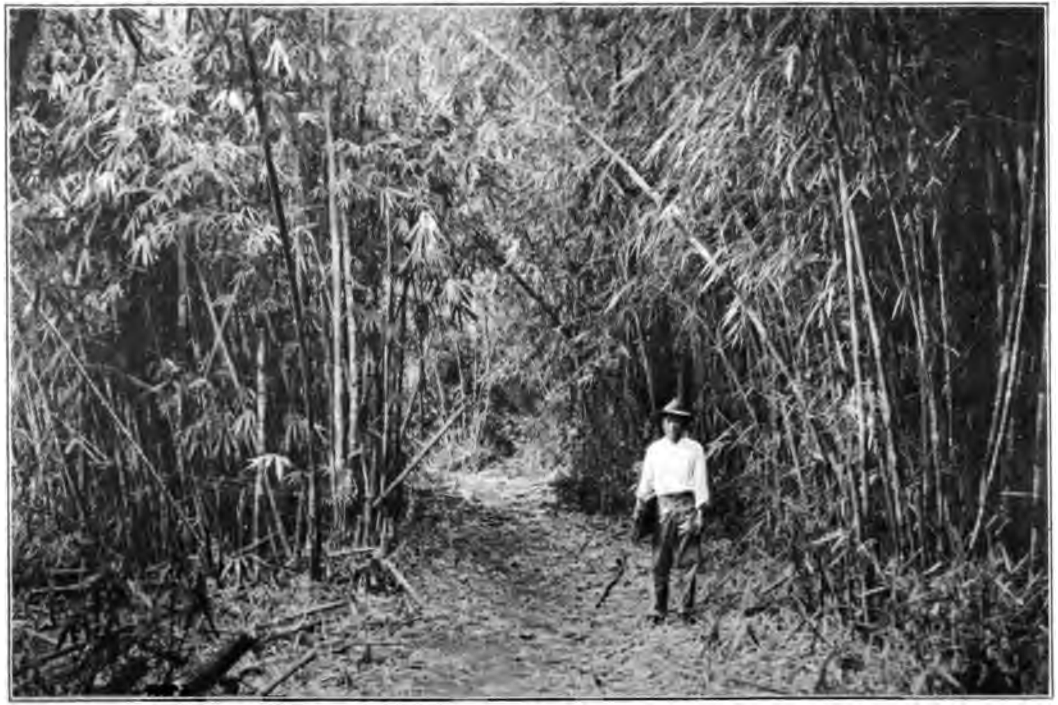

PLATE I. VIEW ALONG A TRAIL IN FOREST OF SCHIZOSTACHYUM LUMAMPAO.

Philippine Bamboos

By William H. Brown, Ph. D.,
Chief, Division of Investigation, Bureau of Forestry; Plant Physiologist, Bureau of Science; and Associate Professor of Botany, College of Liberal Arts, University of the Philippines

and

Arthur F. Fischer, C. E., M. F.,
Director of Forestry; and Dean and Professor of Forestry, School of Forestry, University of the Philippines

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PREFACE

This bulletin is the first of a series to deal with minor forest products. By minor forest products are meant all the products of the forest other than timber, the latter being regarded as the principal product. In the Philippines, as in other tropical forests, the minor products, while of less importance than the timber, are very varied and of great economic value. For this reason, it has been deemed advisable to prepare a series of bulletins dealing with them; particularly as at the present time it is especially desirable to have, in an available form, information concerning our resources. In preparing a work of this kind there are always points concerning which further information would be desirable and in the Philippines there is a great lack of data which would be necessary to make the treatment of the minor forest products reasonably thorough. It is believed, however, that the presentation of such data as we have is advisable particularly as it can then serve as a better starting point for obtaining further information.

The writers are greatly indebted to Mr. E. D. Merrill, of the Bureau of Science, for valuable assistance and suggestions and to Dr. F. W. Foxworthy, formerly chief of the Division of Investigation, Bureau of Forestry, for extensive records left with the Bureau and for helpful criticisms of the present paper. Without the information obtained from Mr. Merrill and from the records left by Dr. Foxworthy, the preparation of the present bulletin would have been impracticable. The authors are indebted to Mr. R. C. McGregor for assistance in preparing this manuscript for the printer.

All plates except VI, VIII, IX, and XXIX are from photographs taken for the writers through the courtesy of the Bureau of Science, Manila, by their official photographer, Mr. E. Cortes.

PHILIPPINE BAMBOOS

By William H. Brown and Arthur F. Fischer

INTRODUCTION

The bamboos form a section of the grass family and contain the largest known grasses, many of which are of tree size. Bamboos, according to form, can be divided into three classes: clump-forming erect species; erect ones which send up shoots singly from an underground stem; and climbing bamboos. Erect clump-forming species are characteristic of tropical countries, while those which send up shoots singly are more characteristic of subtropical or temperate regions. Bamboos are the most useful plants for domestic purposes in the Philippine Islands. Their most promising possibilities for export are as paper pulp, hats, baskets, mats, and matting. These products will be discussed in later bulletins.

In the Philippine Islands are found about 30 species of bamboo, 17 erect and 13 climbing, as follows:

ERECT

Arundinaria niitakayamensis Hayata.
Bambusa cornuta Munro.
Bambusa glaucescens (Willd.) Sieb.
Bambusa merrillii Gamble.
Bambusa spinosa Roxb.
Bambusa vulgaris Schrad.
Bambusa vulgaris striata Gamble.
Dendrocalamus latiflorus Munro.
Dendrocalamus merrillianus Elm.
Gigantochloa levis (Blanco) Merr.
Guadua philippinensis Gamble.
Schizostachyum brachycladum Kurz.
Schizostachyum hirtiflorum Hack.
Schizostachyum lima (Blanco) Merr.
Schizostachyum lumampao (Blanco) Merr.
Dendrocalamus curranii Gamble.

CLIMBING

Cephalostachyum mindorense Gamble.
Dinochloa ciliata Kurz.
Dinochloa elmeri Gamble.
Dinochloa luconiae (Munro) Merr.
Dinochloa pubiramea (Merr.) Gamble.
Dinochloa scandens O. Kuntze.
Schizostachyum luzonicum Gamble.
Schizostachyum curranii Gamble.
Schizostachyum dielsianum (Pilger) Merr.
Schizostachyum diffusum (Blanco) Merr.
Schizostachyum fenixii Gamble.
Schizostachyum palawanense Gamble.
Schizostachyum textorium (Blanco) Merr.
Schizostachyum toppingii Gamble.

At present the climbing bamboos are of slight commercial importance, and are rather a disadvantage than an advantage, as they occupy space which might be utilized by more valuable plants. They grow at the edge of the forest or in deserted caiñgins,[1] or in the forest whenever space has been opened up by the falling of large trees. They require considerable insolation for their best development and then grow very densely—so densely that it is very difficult to penetrate the thickets formed. In fact climbing bamboo forms the most impenetrable thickets that are to be found in our forests. They seem to be decidedly inimical to tree growth, and are hard to eradicate when once they have fully occupied an area.

---

[1] A word used in the Philippines for a clearing made for temporary cultivation.

The erect species may, for convenience, be divided into thick- and thin-walled bamboos. The frame work of a great majority of the houses in the Philippine Islands is constructed from the thick-walled species. Unsplit culms are used for posts, beams, and rafters. The same species, when split and flattened, are used for the sides of houses; or when split in two employed like tiles for roofing. Most frequently the sides and partitions, and occasionally the floors, are formed from thin-walled species split and woven into a coarse matting (sawale).

Sawale is a promising material for the construction of light-material bungalows even in temperate countries. It is also very attractive as an interior finish in strong-material houses. Sawale is of particular advantage in the construction of large temporary buildings. In Manila there is held an annual Carnival, in which very imposing structures are constructed rapidly and cheaply with the aid of this material. When the Philippine National Guard was organized, all the barracks were constructed very quickly on account of the use of sawale. In the entire Philippine exhibits at the Panama-Pacific International Exposition at San Francisco, California, various weaves and classes of sawale were used extensively in the installation of the different booths. This proved so attractive and demonstrated so clearly its use, that people visiting the Exposition ordered material of the heavier weave for summer cottages in California. These orders, aggregating 3,000 linear yards, were for the kind of material used in the exhibits. It was only due to a lack of an organized industry and the subsequent rise in freight rates that a considerable export trade did not result from this beginning.

The domestic uses of bamboo are innumerable and include bridges, fences, rafts, fish-traps, vessels for carrying and storing water, cooking, splints for baskets, hats and mats, vehicle shafts, chairs, cupboards, tables, beds, benches, flower pots, etc. In fact, on account of the ease with which it is worked, bamboo is used for almost every purpose for which wood is employed in temperate countries. The young shoots of many species are also used for food. As an interesting use of bamboo we may mention that complete bands, in some cases having 32 or more pieces, are equipped with musical instruments constructed of bamboo. These pieces are of the same general character as brass instruments and include horns, clarinets, flageolets, saxophones, flutes, piccolos, and drums. A church in Las Piñas, a few kilometers from Manila, has a famous organ with bamboo pipes.

For construction purposes bamboo should be cut a year after it has reached mature size and after the rainy season; that is, in most part of the Philippines, after November. If cut during the rainy season the culms are full of sap, which soon attracts small beetles in great numbers and these rapidly destroy the bamboo. In practice, newly cut bamboo is often kept in water for several weeks in order that the sap, or at least the sugar and starch contents of the sap, may be eliminated. Filipino bamboo carpenters say that when flies gather around the newly worked bamboo, it is a sign that this bamboo is not durable. The flies, of course, are attracted by the sugar in the bamboo.

Owing to the wide distribution of bamboo and the ease with which it is worked without any special implements, it offers a promising field for the development of local household industries for the manufacture of various useful and ornamental articles. If this industry were developed, no doubt considerable export trade could be secured.

Key to the genera of Philippine bamboos.

1. Climbing.
    2. Flowers in widely scattered, dense, globose heads; rare, known only from Mindoro.......... *Cephalostachyum.*
    2. Flowers not in widely scattered, dense, globose heads.
        3. Spikelets very small, ovate.......... *Dinochloa.*
        3. Spikelets elongated, linear or linear-lanceolate. *Schizostachyum.*
1. Erect.
    2. Two and a half meters in height or less, only on high mountains, wild .... *Arundinaria.*
    2. Clumps one to three meters in height, leaves small and whitish, cultivated only.......... *Bambusa glaucescens.*
    2. More than 3 meters in height.
        3. Base of clump protected with long interlaced spiny branches. *Bambusa spinosa.*
        3. Base of clump not protected with long spiny branches.
            4. Culms thin walled; mostly small or medium sized bamboos.
                5. Keels of palea broadly winged; rare, known only from Mindanao.......... *Guadua.*
                5. Palea not winged.......... *Schizostachyum.*
            4. Culms thick walled; mostly large bamboos.
                5. Pericarp thin, adnate to the seed.
                    6. Filaments free.......... *Bambusa.*
                    6. Filaments connate in a thin tube.... *Gigantochloa.*
                5. Pericarp fleshy or crustaceous, separable from the seed .... *Dendrocalamus.*

DESCRIPTION OF SPECIES

Genus ARUNDINARIA Michaux

ARUNDINARIA NIITAKAYAMENSIS Hayata. UTOD.

Among the Igorots, this bamboo is known as utod. It is the only representative of the genus found in the Philippines. This species was originally described from the mountains of Formosa, and is known only from Formosa and the mountains of Luzon. It is locally very abundant, forming dense thickets, at altitudes from 2,100 to 2,600 meters in the Mountain Province, Luzon. This bamboo reaches a height of 2.5 meters, but in unfavorable habitats is frequently only a few centimeters in height. Its maximum diameter is about 1 centimeter. Its only recorded use in the Philippines is for pipestems. A flowering specimen is shown in Plate II.

Genus BAMBUSA Schreber

1. Culms unarmed.
    2. Small shrubby species 2 to 3 meters high with glaucous leaves. *B. glaucescens.*
    2. Coarse species of tree size.
        3. Leaf-sheaths with rounded auricles.......... *B. vulgaris.*
        3. Leaf-sheaths with hornlike, erect processes.
            4. Leaves large; spikelets glabrous; keels of the palea not prominently ciliate.......... *B. cornuta.*
            4. Leaves small; spikelets densely hirsute; keels of the palea prominently ciliate.......... *B. merrillii.*
1. Culms spiny.......... *B. spinosa.*

The genus *Bambusa* is represented by five species, of which at least three appear to have been purposely introduced. It includes the most valuable single species of the entire group in the Philippines. With one exception, all of the species have large, tall culms.

BAMBUSA CORNUTA Munro. LOPA.

Common name: *lopa* (Isinai).

Rare in the forests of Nueva Vizcaya and Benguet, known also from Java. An erect bamboo reaching a height of 7 to 8 meters, and a culm diameter of 3 to 3.5 centimeters, with internodes 40 to 45 centimeters long. It is characterized by prominent horns at the tip of the leaf sheath. A flowering specimen is shown in Plate III.

BAMBUSA GLAUCESCENS Sieb. KAWAYAN-CHINA.

Common names: *kawayan-china, kawayan-sina* (Tagalog).

Kawayan-china is a native of China or Japan and occurs in the Philippines only as an introduced and cultivated plant.

The clumps are usually from 1 to 3 meters in height, the culms up to 2 centimeters in diameter. The culms may be 5 meters in length but when long are usually much bent. The leaves are from 3 to 10 centimeters long and whitish in appearance. This species is planted for ornamental purposes and in some parts of Manila is used as a hedge plant. The stems are used for fishing rods.

BAMBUSA MERRILLII Gamble.

This species is known only from collections from the Caraballo Sur mountain ranges in Nueva Vizcaya, where it grows in forests at an altitude of about 600 meters.

It is an erect straggling species about 18 meters in height. See Plate IV.

BAMBUSA SPINOSA Roxb. (*B. blumeana* Schultes f.). SPINY BAMBOO.

Common names: *dugían, kabugáwan, marurúgi, rugían* (Bikol); *kawáyan, kawáyan totóo* (*i. e. true bamboo*), *kawáyan tiník* (Tagalog); *aon-o, batákan, paua, kawáyan-gid* (Bisaya); *kawáyan si-ítan* (Iloko); *bayog* (Zambales); *lam-nuan* (Isinai); *baugin* (Pampanga); *pasingan* (Cagayan); *caña espina* (Spanish).

This bamboo is the one to which the name kawayan is most frequently applied. It is found throughout the settled areas of the Philippines at low and medium altitudes, and is apparently always planted, there being no valid reason for considering it a native of the Archipelago. This bamboo was apparently purposely introduced at an early date. Spiny bamboo, as well as the other large, probably introduced species, has been cultivated quite extensively in clearings which have since been abandoned, so that considerable areas are now covered by virtual forests of this species. Spiny bamboo offers considerable possibilities as a valuable reforestation crop.

Spiny bamboo reaches a height of about 25 meters and a culm diameter of 20 centimeters. The internodes are usually hollow, and from 40 to 60 centimeters in length. The culms have thick walls, becoming progressively thicker toward the lower part of the culm. It occasionally happens that the lower internodes are so thick walled that they become almost or quite solid. The stem contains a large amount of silica and sometimes an internode is completely filled with a hard white siliceous mass, which damages any instrument use in cutting it. This bamboo is rarely found in flower and the interval between flowering periods is not known. It is by far the most commonly used bamboo in the Philippines, being prized above all others by the Filipinos for building purposes on account of its great strength and durability. It is distinguished from all other species of Philippine bamboos by the fact that it grows in large clumps, the basal portions of which are surrounded to a height of from 2 to 3 meters by a densely interlaced thicket of very spiny branches, which make access to the culms exceedingly difficult. The function of these spiny branches, apparently, is to protect the delicate young shoots from herbivorous animals. This species is illustrated in Plates V to VII.

The splints from green stems of this species are used extensively in the manufacture of baskets and hats, it being the most valuable species for hatmaking. It also has some commercial possibilities for paper pulp. The basal portions of the culms have been used as heads for polo mallets and for shuttles on hand looms.

Distributed in southern China, Indo-China, Malay Peninsula, and Malay Archipelago.

BAMBUSA VULGARIS Schrad. KAWÁYAN-KILÍNG.

Common names: *kawayan-kilíng*, *kawayan bayúgin*, *kawayan hobéro*, *taiwanák*, *tewanák* (Tagalog); *bulínau*, *burírau*, *lúnas*, *sinambáng* (Bisaya); *kabolóan* (Bikol).

This is a clump-forming spineless bamboo, which reaches a height of about 17 meters or more and a diameter of about 12 centimeters. The stems are smooth, usually yellowish or yellowish-green. It is usually smaller than *Bambusa spinosa* and has thinner walls. This species is illustrated in Plates VIII to X.

Kawayan-kiling is one of the building bamboos and is generally utilized in the regions where it grows for the various purposes, such as house construction, bridges, furniture, for which the coarse erect bamboos are adapted. It is much inferior to *Bambusa spinosa.* Like the spiny bamboo, it is probably not a native of the Philippines, but was purposely introduced in prehistoric times on account of its general utility. The variety *striata* Gamble is occasionally cultivated in Manila and in other large towns for ornamental purposes; it is readily distinguished by its culms being bright yellow with a few green stripes. This form is a native of China or Japan, but is now widely distributed in cultivation.

The native country of *Bambusa vulgaris* is so far unknown; it is cultivated and half wild in Asia, Africa, and America.

Genus CEPHALOSTACHYUM Munro

CEPHALOSTACHYUM MINDORENSE Gamble. BAKTO.

This species is rare and known only from Mindoro. It is a climbing species well characterized by having its flowers in dense globose, widely scattered heads the larger of which are about 2 centimeters in diameter. See Plate XI.

Genus DENDROCALAMUS Nees

Spikelets large; leaves large .... *D. latiflorus.*
Spikelets medium-sized; leaves long .... *D. curranii.*
Spikelets very small .... *D. merrillianus.*

This genus of large erect bamboos is represented by three species. It is economically unimportant and none of the species are especially abundant.

DENDROCALAMUS CURRANII Gamble.

A rare species known only from Sampaloc, Tayabas, and the Island of Polillo off the coast of Luzon, and possibly not distinct from *Gigantochloa levis.*

DENDROCALAMUS LATIFLORUS Munro. BOTÓNG.

Common names: *botóng, bolong-sína* (Bikol, Bisaya); *butún* (Bisaya); *kabolóan, patóng* (Bikol); *kawáyan-sína* (Tagalog).

This is a tall, tufted, spineless bamboo apparently of general distribution in the central Philippines. It is frequently utilized for building purposes, but is not considered to be good material for basketry.

DENDROCALAMUS MERRILLIANUS Elm. BAYOG.

Common names: *bayóg* (Ilocos); *kawáyan-bayóg* (Pangasinan).

This bamboo is apparently widely distributed in the Philippines. It is a tall graceful bamboo with slender stalks forming large clumps. The culms have very thick walls and prominent nodes. They are used for vehicle shafts and for other purposes where great strength is desired. The green culms of this bamboo are split and made into ropes, used particularly for hauling logs. A flowering specimen is shown in Plate XII.

Genus DINOCHLOA Büse

1. Woody.
    2. Leaves broad.
        3. Lodicules absent; caryopsis globose; floral rachis glabrous. *D. scandens.*
        3. Lodicules present; caryopsis oblong; floral rachis pubescent. *D. pubiramea.*
    2. Leaves narrow; no lodicules.
        3. Culms smooth; caryopsis globose .... *D. ciliata.*
        3. Culms rough; caryopsis oblong .... *D. luçoniae.*
1. Herbaceous, or woody only at the base; lodicules present .... *D. elmeri.*

The genus *Dinochloa* is represented in the Philippines by five species. With one exception our representatives are all scandent, thick-walled, sylvan forms and are locally very abundant, forming almost impenetrable thickets under favorable conditions.

No special economic uses are indicated for any of the forms, yet like all bamboos they are more or less utilized by the Filipinos for general purposes. They should be adapted to the same special uses as the thick-walled scandent species of *Schizostachyum.* The most common species is *Dinochloa scandens,* zigzag bamboo, (Plate XVIII) which is abundant and widely distributed in the central and southern Philippines; it is characterized by its very broad leaves and is variously known as baía in Palawan, bokáue in Balabac, bukáu in Basilan, usíu, timák, and bolokáui in Mindoro. Most of these names are also used for the scandent species of *Schizostachyum. Dinochloa luçoniae* (Plate XVI) is very similar in general character to *Dinochloa scandens,* but has much narrower leaves, which is also true of *Dinochloa ciliata* (Plate XIV). *Dinochloa luçoniae* is known as baíto (Tagalog) and esu (Iloko). *D. pubiramea* (Plate XVII) is a broad leaved species similar to *D. scandens* and distinguished chiefly by having the branches of the inflorescence pubescent. Its local names are kandy (Bis.) and bukáo (Moro). *Dinochloa elmeri* (Plate XV) is a dwarfed, half woody form growing in the mossy forest at the summits of high mountains.

Genus GIGANTOCHLOA Kurz

GIGANTOCHLOA LEVIS (Blanco) Merr. BOLO.

Common names: *kawáyan-bóo, kawayan-sína, kawáyan-putí, bohó* (Tagalog); *bokó, boló, botóng* (Bisaya).

Gigantochloa levis is a stout bamboo reaching a height of 20 meters or more and a culm diameter of 20 centimeters. Its culms are very straight and smooth, dull green, covered with siliceous pubescence, and entirely unarmed. It is found in and about towns in the settled areas of the Philippines, and also in the forests. The stems are used as pipes for temporary water supplies, as they are usually long and straight, and for building fish traps. They are, apparently, rarely employed in building operations, except for walls of houses, perhaps because they are not especially durable. A flowering specimen is shown in Plate XIX.

The Philippine specimens referred to *Gigantochloa robusta* Kurz and *Gigantochloa atter* Kurz are not considered by Mr. E. D. Merrill to be specifically distinct from *G. levis.*

Genus GUADUA Kunth

GUADUA PHILIPPINENSIS Gamble.

This is a rare species known only from a single collection from Mindoro. The nodes are reported to be about 75 centimeters long and 2.5 to 5 centimeters in diameter. The culms are thin-walled and 4 to 6 meters in height. A cotype specimen is shown in Plate XX.

Genus SCHIZOSTACHYUM Nees

1. Climbing.
    2. Flowers in long panicles, usually from flower-bearing culms or auxillary on leafy ones.
        3. Leaves usually broad, rounded at the base, mouth of leaf sheaths and ligules long-bristly-ciliate.
            4. Spikelets glabrous .... *S. diffusum.*
            4. Spikelets densely pubescent .... *S. fenixii.*
        3. Leaves usually narrow attenuate at the base, mouth of leaf sheaths and ligules not or only slightly bristly.
            4. Spikelets very sharply pointed; apicules of anthers shortly hirsute .... *S. dielsianum.*
            4. Spikelets acute only; apicules of anthers very long bristly. *S. palawanense.*
    2. Flowers in short, terminal spikes up to 10 centimeters long; leaves very narrow .... *S. textorium.*
1. Erect.
    2. Spikelets sharply pointed, not in rounded capitula. *S. longispiculatum.*
    2. Spikelets sharply pointed, usually in rounded capitula; no lodicules.
        3. Spikelets glabrous outside.
            4. Internodes about a meter or more in length or longer. *S. lima.*
            4. Internodes shorter .... *S. brachycladum.*
        3. Spikelets more or less pubescent outside; anthers obtuse.
            4. Spikelets densely white-hairy, both on the empty and on the flowering glumes; leaves 1 centimeter broad. *S. hirtiflorum.*
            4. Spikelets shortly white-hairy only on the flowering glume; leaves over 1.5 centimeters broad .... *S. lumampao.*
    2. Spikelets hardly sharp-pointed, obtuse or acute, usually in long panicles; lodicules usually present .... *S. luzonicum.*

The genus *Schizostachyum* is extensively developed in the Philippines. Among the bamboos it has by far the largest number of species, and presents several of the most common and widely distributed bamboos in the Archipelago. All of the species are indigenous, and none of them are cultivated. The genus contains both erect, thin-walled species, and scandent thick-walled ones, several of which are used for special purposes. None of the species are of large size. Most of them are sylvan or subsylvan and usually do not occur in the open settled areas. Several of them are gregarious and in some provinces occupy rather large areas of land to the practical exclusion of other vegetation.

SCHIZOSTACHYUM BRACHYCLADUM Kurz.

Common names: *bohó* (Isinai and Mindanao); *bagákai* (Leyte); *bagákan* (Palawan).

This is an erect bamboo about 10 meters in height and up to 5 centimeters in diameter. A gregarious species abundant in Palawan and Culion on dry open slopes. Reported from Nueva Vizcaya, Leyte, Butuan, and Palawan. A flowering specimen is shown in Plate XXI.

SCHIZOSTACHYUM DIFFUSUM (Blanco) Merr. BÍKAL.

Common names: *bíkal* (Tagalog, Iloko, Pampanga, Pangasinan, Cagayan); *usíu* (Tagalog); *baliáro, balikáu, bongbong, lo-ob* (Bisaya); *hindi, indi, inri* (Bikol); *butor* (Isinai); *bábui* (Bikol).

Bikal is widely distributed in the forests of the Philippines and is endemic. It is characterized not only by its habit, but also by its very thick walls. Sometimes the lumen is almost entirely wanting, especially in the lower parts of the stem. The plant is well known to all Filipino woodsmen as a source of drinking water, as water of good quality can be secured from the internodes. In some parts of the Philippines this bamboo is extensively used in making baskets, while it is now beginning to attract attention for the purpose of making chairs, for which it is adapted on account of its thick stout walls. A flowering specimen is shown in Plate XXIV. The very closely allied *Schizostachyum dielsianum*, bikal-bábui, (Plate XXII) has the same names, distribution, and uses as *S. diffusum*, and is distinguished only by minor characters.

SCHIZOSTACHYUM LIMA (Blanco) Merr. ANOS.

Common name: *anos* (Tagalog).

This endemic, erect, thin-walled bamboo is distinguished among all the Philippine forms by its long internodes, which are usually about one meter in length. It is sometimes called boló and bagákai by confusion with *Schizostachyum lumampao*. It is used by the Filipinos for making blow guns, while the cortex is hard and rough and can be used for polishing brass. It is also used for the various purposes for which all thin-walled bamboos are utilized, and after boiling, even for weaving fans, cushions, and hats; broad splints prepared from it are used in making the broad shallow baskets used for winnowing rice. Widely distributed in the Philippines. A flowering specimen is shown in Plate XXVII.

SCHIZOSTACHYUM LUMAMPAO (Blanco) Merr. BÚHO or CAÑA-BOJO.

Common names: *caña-bojo* (Spanish-Filipino); *bólo, boho, lumampáu. bokáui, kauáyan-songsóng* (Tagalog); *bagákan, bagákai* (Bisaya); *búlu, bolo* (Bisaya, Iloko); *orás* (Bikol).

This species is endemic and widely scattered in the Philippines. It is a thin-walled, erect, gregarious bamboo usually reaching a height of about 10 meters, and often nearly exclusively occupying considerable areas. Forester Medina has surveyed two tracts of this bamboo in Bataan Province, one containing 1,200 hectares, of which 800 hectares have a dense stand; the second containing 650 hectares, of which more than 40 per cent is covered with *Schizostachyum lumampao.* There are also very extensive areas in other parts of Bataan, in Zambales, and in the Cagayan Valley. Fifteen small plots of *Schizostachyum lumampao* have been measured in Bataan Province back of the town of Limay. These plots aggregated 3.5 hectares and covered stands at widely separated intervals. The surveys showed an average of 8,983 canes per hectare. One of the surveys of one quarter of a hectare indicated a stand of 19,162 canes per hectare.

This thin-walled bamboo is the species chiefly utilized in making the building matting known as sawale. It is also used for making baskets, fences, fish corrals, fish poles, flutes, and for many other purposes.

Buho has been thoroughly investigated by Richmond as a paper-making material, and it is probably the one species of Philippine bamboo that, without extensive cultivation, promises commercial possibilities for this purpose. This point will be discussed in a bulletin on paper. Observations on its rate of growth are given later. This species is illustrated in Plate I (frontispiece) and Plates XXVIII and XXIX.

SCHIZOSTACHYUM TEXTORIUM (Blanco) Merr. KALBÁNG.

Common name: *kalbáng* (Tagalog).

This is an erect bamboo with small leaves, which is locally abundant in the Provinces of Batangas and Rizal, Luzon. The stems are used in the manufacture of looms, as they are very straight and smooth. A flowering specimen is shown in Plate XXXII.

Among the other Philippine representatives of the genus are *Schizostachyum palawanense* (Plate XXXI), a scandent species known from Palawan and Laguna; *S. hirtiflorum* (Plate XXVI), a widely distributed species closely allied to and with the same growth form as *S. lumampao; S. toppingii* (Plate XXXIII), erect or subscandent, reported from Laguna, Rizal, and Mindoro; *S. curranii* (Plate XXIII), scandent, a species of higher altitudes in northern Luzon; *S. luzonicum* (Plate XXX), known only from Zambales; and *S. fenixii* (Plate XXV), reported from Abra, Cagayan, Benguet, Ilocos Sur, and Panay, known as paua in Iloilo, and puser in Abra, Luzon, and there utilized in the manufacture of baskets.

PLANTING OF BAMBOO

Until very recently almost no reliable information concerning the rates of growth of planted Philippine bamboo was available. For this reason, Mr. H. M. Curran and Dr. F. W. Foxworthy in 1912 started a bamboo plantation at the Division of Investigation of the Bureau of Forestry at Los Baños, Laguna, the direction of the planting being intrusted to Rangers de Mesa and Villamil. This plantation was started on a rather dry hill on steep slopes, covered with a mixture of tall grass and small second-growth trees. The material selected for planting was from shoots 1 to 2 years old or older from poorly grown plants which were overtopped and not well supplied with light, and from upper twigs. A few butts were also used. The length of cuttings was from 60 centimeters to 2 meters. The cuttings were collected 3 to 36 hours before planting, and were laid in water at the edge of a stream whenever it was not possible to plant immediately. During the time that this work was done the weather was very rainy and so there was less than the usual amount of drying out. The planting was done between August 29 and October 10, 1912. The implements employed were mattocks and heavy pointed sticks, the mattocks being used only when rocky soil was encountered or when very large pieces were to be planted. In all there were planted 1,015 cuttings of *Bambusa spinosa,* 145 of *Bambusa vulgaris,* and 105 of *Gigantochloa levis.* The area of the plantation was 2.2 hectares. More than half of the area was covered with a dense tangle of small trees and climbing bamboo. All of the small brush and climbing bamboo was cut, but some of the larger trees were left to shade the young plants. Where the bamboo was shaded it has done better than it has in the open. This may perhaps be due to the fact that the planting was done toward the end of the rainy season so that the young shoots were exposed to dryer conditions than they would have been if planted earlier.

On January 10, 1914, the living bamboos were counted; these included 349 individuals of *Bambusa spinosa* or 34 per cent of the original number planted, 46 of *B. vulgaris* or 32 per cent, and 6 of *Gigantochloa levis* or 6 per cent. This low percentage of success was probably due in part to several avoidable causes. The planting was done toward the close of the rainy season, so that young plants did not have as favorable moisture conditions as they would have had if planted earlier. Again the methods of planting, as previously described, were not favorable, while some of the young plants are known to have been destroyed by cattle; moreover, the selection of material was poor, and the site unfavorable. The best material for planting is from stumps, which, though harder to prepare, will probably be cheapest in the long run. Small twigs are much harder to handle than larger pieces. The cutting should be planted oblique to the ground. Planting material should be taken from full size shoots which are not fully mature. Subsequent careful planting of small numbers of these same bamboos in the early part of the rainy season gave 100 per cent success.

During the year 1914, blanks in the plantation were filled.

Bamboo cuttings, at first, send up thin whiplike shoots and it is only after a considerable period that regular culms are produced. The number and size of these culms increases yearly until mature size is reached.

In Table 1, from a report by Ranger Oro, is given a summary of the height of the culms in December, 1915; from this table, it will be seen that in three years some of the culms had reached a height of from 8 to 9 meters, but that most of them were much smaller than this.

TABLE 1.—*Heights of bamboo clumps at Division of Investigation, Bureau of Forestry, Los Baños, Laguna, P. I., December, 1915, three years after planting.*

[The figures in the table give the number of clumps.]

Species.	Height in meters.							
	Less than 2.	2-3.	3-4.	4-5.	5-6.	6-7.	7-8.	8-9.
Bambusa spinosa	85	59	65	27	16	13	10	10
Bambusa vulgaris	11	12	12	6	3	1	1	1
Gigantochloa levis		1	1	2	.....	.....	1	2

In Table 2, also from a report by Ranger Oro, is given a summary of the height of the clumps and the diameter of the canes in October, 1917. It will be seen that, five years after the original planting, most of the culms were still small, but 26 clumps of *Bambusa spinosa,* one of *B. vulgaris* and one of *Gigantochloa levis* were between 13 and 15 meters in height and seven of *Bambusa spinosa* over 15 meters in height. *Bambusa spinosa* had produced 80 culms, 7 centimeters in diameter; 71, 8 centimeters; 29, 9 centimeters; and 17, 10 centimeters in diameter; while *Gigantochloa levis* had produced 3 culms, 11 centimeters in diameter. The culms of *Bambusa vulgaris* were smaller, the largest being 8 centimeters in diameter. These figures show that in five years, the planted bamboo had produced some usable culms; and, judging from the difference in the size of the bamboo in 1915 and 1917, it may be predicted that a considerable number of usable canes would be produced in another two years.

TABLE 2.—*Heights of bamboo clumps and diameters of canes at Division of Investigation, Bureau of Forestry, Los Baños, Laguna, P. I., October, 1917, five years after planting.*

[Figures represent number of clumps.]

Species.	Height of clumps in meters, October, 1917.								
	Less than 1.	1-3.	3-5.	5-7.	7-9.	9-11.	11-13.	13-15.	15-17.
Bambusa spinosa	2	26	24	32	53	55	44	26	7
Bambusa vulgaris	1	6	8	5	7	5	7	1	......
Gigantochloa levis	......	......	......	1	1	1	3	1	......

[Figures represent number of canes.]

Species.	Diameter of canes in centimeters. October, 1917.							
	Less than 5.	5.	6.	7.	8.	9.	10.	11.
Bambusa spinosa	994	150	97	80	71	29	17	......
Bambusa vulgaris	153	11	10	5	4	......	......	......
Gigantochloa levis	33	11	8	3	4	2	2	3

In Table 3 is given a summary of the number of cuttings planted in 1912 and the condition of the plantation at subsequent dates.

TABLE 3.—*Summary of bamboo cuttings planted at Division of Investigation, Bureau of Forestry, Los Baños, Laguna, P. I., in 1912, and condition of plantation at subsequent dates.*

Summary.	Species.		
	Bambusa spinosa.	Bambusa vulgaris.	Gigantochloa levis.
Number of cuttings planted in 1912	1,015	145	105
Number of clumps alive, January 10, 1914	349	46	6
Per cent of original planting alive, January 10, 1914	34.38	31.72	5.71
Number of clumps, December, 1915	285	47	7
Total number of canes, December, 1915	628	98	30
Average height, December, 1915	3.01	2.81	5.57
Number of clumps, October, 1917	269	40	7
Total number of canes, October, 1917	1,440	183	66
Average number of canes per clump, October, 1917	5.04	4.56	9.40
Greatest diameter of canes in centimeters, October, 1917	10	8	11
Greatest height in meters, October, 1817	16.87	13.11	13.14
Average height in October, 1917	8.51	6.87	10.40

The area planted was 22,000 square meters. The time employed in selecting cuttings was 200 hours, in clearing 207 hours, and in planting 140 hours, making a total of 547 hours. Assuming labor at 10 centavos per hour, the cost of planting would be 25 pesos per hectare, planting being at intervals of 2 to 3 meters. During the first four years the plantation was cleaned twice a year, which included the cutting back of vines and felling and pruning of trees. This was done at a cost of about 10 pesos per hectare, per year, with labor at 10 centavos per hour.

A second bamboo plantation was started by Dr. F. W. Foxworthy at the Division of Investigation, Bureau of Forestry, at Los Baños, during June, 1917. This plantation covered 2 hectares and was planted with a single species, *Bambusa spinosa*. The planting was done in the months of June and July during the early part of the rainy season. The ground was covered largely with small trees and climbing bamboos, there being very little grass. The climbing bamboos were cut, but the trees left standing. The planting was done with stump and stem cuttings. The stump cuttings used had roots and were about a third of a meter in length. They were planted either in a slanting position or erect. A stem cutting consisted of a segment with a node at either end. A slit was made in the internode, and then the whole segment buried in the ground, except that the slit was left uncovered to permit water being poured into the internode. In all there were planted 225 stump cuttings and 800 stem cuttings.

All of the living shoots were counted and measured during December, 1917, and again at the end of June, 1918, when the plants were about a year old. The results of the measurements are given in Table 4. An examination of Table 4 shows that at the end of the year 59 per cent of the stump cuttings and 40 per cent of the stem cuttings were alive. A comparison of these figures with those given in Table 3 indicates a greater percentage of success in the second than in the first plantation.

TABLE 4.—*Record of plantation of Bambusa spinosa at Division of Investigation, Bureau of Forestry, Los Baños, Philippine Islands.*

	Number of cuttings planted June July, 1917.	December, 1917.			June, 1918.		
		Number living.	Height, centimeters.	Percentage living.	Number living	Height, centimeters.	Percentage living.
Stump cuttings	225	198	150	88	133	260	59.1
Stem cuttings	800	560	150	70	320	210	40.0

There is, however, reason to believe that much better results than those recorded in Table 4 could be obtained as the dry season of 1918 was unusually severe and the plants were not irrigated. It will be noticed that there was a high percentage of mortality between December, 1917, and June, 1918. Moreover, many of the plants were probably subjected to too much shade, as they were freed from vines only once during the year and in general those plants which survived received more light than those which died.

The total cost of selecting, transporting, and planting the cuttings were 72.82 pesos per thousand. This cost was considerably more than in the case of the 1912 plantation, which is accounted for by the greater care used in the selection of cuttings for the second than the first plantation. The superior cuttings used in 1917, however, gave much better results than the poorer ones employed in 1912.

It appears from the data derived from the planting at Los Baños that the commercial planting of bamboo on a large scale would be very profitable and that bamboo should be a valuable reforestation crop.

A number of bamboos, other than those here considered, have been propagated from hard-wood cuttings at the Division of Investigation of the Bureau of Forestry at Los Baños, and it is probable that all or most Philippine bamboos can be thus reproduced.

GROWTH OF MATURE CLUMPS

Actual measurements of growth of canes in mature clumps are available for only three species, *Bambusa spinosa, Bambusa vulgaris,* and *Gigantochloa levis.* A clump of *Bambusa spinosa* sends up yearly a number of shoots, the number in some cases being as large as 130. In clumps from which the mature canes are harvested, the number of new shoots may exceed the number left in the clump when the new culms are produced. A considerable proportion of the young shoots die before reaching maturity, many of them while still quite small. In Table 5 are given observations on the number of shoots produced by 8 clumps of *Bambusa spinosa.* The greatest number of canes produced by any clump recorded in Table 5 is 128; these grew from a clump having 49 mature canes. However, only 24, or 19 per cent of the 128 canes, reached maturity. The average of all the canes produced, by the 8 clumps, which reached maturity is 28.5 per cent. In all, the number of mature canes produced is 46.5 per cent of the total mature canes originally in the clumps.

TABLE 5.—*Number of shoots produced and yield of mature living canes from 8 clumps of Bambusa spinosa at Division of Investigation, Bureau of Forestry, Los Baños, Laguna, Philippine Islands. Data from report by Ranger Oro.*

Total number of mature canes.	New shoots.			Percentage living.	Percentage yield.
	Total number of shoots.	Total number of dead.	Total number of living.		
39	78	58	20	25.5	51
24	29	24	5	17.5	21
18	20	10	10	50	55.5
21	30	22	8	26.5	38
8	12	9	3	25	37.5
13	34	25	9	26.5	69
31	35	19	16	45.5	51.5
49	128	104	24	19	49
Average				28.5	46.5

Observations were also made on 5 clumps of *Bambusa vulgaris.* The results are given in Table 6. Thirty-eight per cent of the young shoots reached maturity, which is 6 per cent of the original number in the clump. *Bambusa vulgaris* produced fewer canes than *Bambusa spinosa,* but showed the same general phenomena which have just been described for *Bambusa spinosa.*

TABLE 6.—*Number of shoots produced and yield of mature living canes from 5 clumps of Bambusa vulgaris at Division of Investigation, Bureau of Forestry, Los Baños, Laguna, Philippine Islands. Data from report by Ranger Oro.*

Total number of mature canes.	New shoots.			Percentage living.	Percentage yield.
	Total number of shoots.	Total number of dead.	Total number of living.		
48	48	34	14	29	29
9	24	13	11	46	122
30	39	30	9	23	30
22	20	12	8	40	36
44	52	25	27	52	61
Average				38	56

Gigantochloa levis also produces a very large number of new shoots, many of which fail to mature. Records obtained from 5 clumps of *Gigantochloa levis* are given in Table 7. It will be seen from this table that 31 per cent of the new shoots reached maturity while the yield of the new culms is 54 per cent of the number originally in the clump.

TABLE 7.—*Number of shoots produced and yield of mature living canes from 5 clumps of Gigantochloa levis at Division of Investigation, Bureau of Forestry, Los Baños, Laguna, Philippine Islands. Data from report by Ranger Oro.*

Total number of mature canes.	New shoots.			Percentage living.	Percentage yield.
	Total number of shoots.	Total number of dead.	Total number of living.		
22	36	25	11	31	50
16	39	27	12	31	75
12	26	19	7	27	58.5
10	14	10	4	28	40
60	72	45	27	37.5	45
Average				31	54

The death of the young shoots is due to various causes; some of them are attacked by insects or rats; others are broken by the wind; while still others die without any very apparent reason, but probably because under the existing conditions more shoots are produced than can be matured by the clump. This may be due to scarcity of food, water or other causes, but concerning this point we have no information.

The culms of *Bambusa spinosa* and *Bambusa vulgaris* start to grow during the latter part of the dry season, but make very slow growth until the rainy season. *Gigantochloa levis* starts to grow about the beginning of the rainy season. The period of rapid growth is in the latter part of the rainy season. *Bambusa spinosa, Bambusa vulgaris,* and *Gigantochloa levis* reach about full height in approximately five months. This means that for this period there is an average daily growth in large culms of *Bambusa spinosa* of about 17 centimeters, in *Bambusa vulgaris* of about 13 centimeters, and in *Gigantochloa levis* of 13 centimeters.

Beginning with 1912 and extending up to the present time, measurements of the rate of growth of bamboos have been taken by the Division of Investigation of the Bureau of Forestry at Los Baños, Laguna, by means of a measured stick. The most extensive series of measurements of large culms were made by Ranger Oro in 1915. From this series we have selected for presentation in the following tables all shoots of *Bambusa spinosa* which reached a height of more than 20 meters, and of *Bambusa vulgaris* and *Gigantochloa levis* which reached a height of more than 12 meters. This selection has been made so as to represent the growth of only large commercial culms.

In Table 8 are given the measurements of the rates of growth of *Bambusa spinosa.* The first measurement was taken on June

5, 1915, while a considerable proportion of the canes were not measured until after this date. The height at the time of the first measurement is given in the first row of figures in the table. Each column shows the growth figures for a single culm during successive weeks, the first space in each column being for the week ending June 12. When measurements were not started until later than June 5, the first measurement of growth is recorded lower in the column, the number of blanks appearing before the first measurement of growth indicating the number of weeks after June 5 that the first measurement was taken. It will be seen that, as is usual in the growth of plant parts, the rate is at first slow and gradually increases until it reaches a maximum, after which it decreases as the culms assume mature size. The most rapid growth usually occurs nearer the end than the beginning of the growth period and takes place in the latter part of the rainy season. Three of the shoots showed a weekly growth in excess of 3 meters; the fastest rate was 3.17 meters, or an average of 45 centimeters a day for a week.

TABLE 8.—*Growth of culms of Bambusa spinosa, at Division of Investigation, Bureau of Forestry, Los Baños, Laguna, Philippine Islands. Data from report by Ranger Oro.*

Height in meters at first measurement.									
.24	.16	.29	.06	.40	.14	.40	.18	.31	.27
Growth in meters during successive weeks.									
.04	.08	.09	.00	....	....	.21	.08	....	....
.13	.09	.16	.02	....	....	.56	.12	....	....
.13	.09	.20	.03	.21	....	.84	.14	....	....
.48	.16	.74	.04	.50	....	1.19	.41	....	....
.73	.11	.82	.04	.59	.00	1.21	.81	.45	.29
.95	.43	1.35	.11	1.03	.02	1.39	1.24	.71	.85
1.43	.83	1.81	.15	1.23	.10	2.48	1.22	1.11	1.13
1.57	1.10	2.32	.31	1.68	.54	2.45	1.68	1.20	1.51
1.56	1.41	2.19	.72	1.65	.89	1.88	1.12	1.72	1.67
1.34	1.29	2.97	.86	1.76	.91	1.99	2.96	2.04	2.76
1.22	1.49	1.33	1.15	1.26	1.56	2.92	2.40	1.81	2.33
1.37	1.87	.94	1.20	1.75	1.63	1.84	1.33	2.63	2.02
1.48	1.73	1.02	1.09	1.91	2.44	1.63	2.88	1.58	2.51
1.56	1.89	1.10	1.77	1.96	2.12	1.84	2.42	2.62	1.60
1.60	2.10	2.15	2.59	1.85	2.18	1.21	2.30	1.75	1.40
2.85	2.75	1.65	2.93	2.34	1.79	....	....	1.71	1.66
2.44	2.83	2.02	3.05	1.54	2.09	....	....	1.05	1.57
1.53	1.94	1.26	2.88	.75	2.84	....	....	.94	1.15
.71	1.40	....	1.18	....	1.37	....	....	.68	.58
....	.80	....	.92	....	1.04	....	....	....	....
Total height.									
23.36	24.00	24.41	21.10	22.41	21.66	24.04	21.29	22.31	23.30

TABLE 8.—*Growth of culms of Bambusa spinosa, etc.*—Continued.

Height in meters at first measurement.									
.32	.23	.44	.39	.35	.27	.24	1.6	.24	.54
Growth in meters during successive weeks.									
.12	.06				.12	.20	.08	.10	
.16	.13				.17	.22	.15	.20	
.45	.19	.16	.14	.56	.56	.70	.34	.56	.44
1.00	.70	.50	.20	.98	.94	1.04	.92	1.01	.97
1.15	.99	.85	.45	1.11	1.29	1.10	.95	1.49	1.25
1.73	1.22	1.07	.77	1.73	1.49	1.65	1.56	1.48	1.43
1.64	1.60	1.34	1.19	1.97	2.09	2.11	2.33	2.08	1.92
2.09	1.00	1.64	1.23	2.35	2.06	2.51	1.79	2.13	2.26
2.26	2.00	1.21	1.79	2.80	2.25	1.97	2.23	2.35	2.18
3.17	2.75	2.88	2.13	2.86	2.64	2.89	2.20	2.38	2.67
2.49	2.35	2.24	1.80	1.98	2.63	2.91	2.36	2.76	2.68
1.95	3.07	2.31	2.65	2.33	2.43	2.80	2.58	2.46	2.94
1.85	2.61	2.89	2.94	1.93	1.94	1.09	1.49	1.74	1.63
1.58	2.68	2.03	2.15	1.11	1.01		1.94	1.18	1.23
1.06	1.47	1.89	2.57	.78	.78		.90	.77	.91
	.96	1.43	1.72						
		.91	.75						
Total height.									
23.02	24.01	23.79	22.87	22.84	22.62	20.93	21.98	22.93	23.05

From the table it would appear that the period of most rapid growth of any individual culm depends rather on the height of the culm than on the season.

The culms for which measurements are given in Table 8 were all large or fairly large; smaller culms show slower rates of growth, but mature in about the same length of time.

In Table 9 are given measurements of the growth of culms of *Bambusa vulgaris*. This table is constructed in the same manner as the previous table for *Bambusa spinosa*. The rates of growth are slower than those for *Bambusa spinosa*, as might be expected from the fact that *Bambusa vulgaris* is a smaller bamboo. These figures show even more clearly than do those for *Bambusa spinosa* that the time of most rapid growth depends more on the stage of the development of the culm than on the season.

TABLE 9.—*Growth of culms of Bambusa vulgaris, at Division of Investigation, Bureau of Forestry, Los Baños, Laguna, Philippine Islands. Data from report by Ranger Oro.*

Height in meters at first measurement.										
.10	.17	.20	.14	.45	.12	.18	.12	.16	.03	.05
Growth in meters during successive weeks.										
				.40	.00			.00	.01	
				.91	.00			.07	.03	
				.92	.02			.00	.04	.12
			.00	1.34	.00			.02	.03	.01
.06			.00	.96	.00	.04	.04	.06	.02	.08
.08			.09	1.60	.08	.00	.01	.09	.05	.17
.08	.07	.10	.03	1.42	.17	.14	.06	.12	.14	.17
.15	.06	.20	.04	1.71	.35	.46	.14	.25	.28	.73
.39	.10	.51	.46	1.41	.26	.56	.24	.16	.98	.93
.83	.38	.84	.94	2.26	1.09	1.08	1.13	.82	.99	.97
1.04	.89	1.05	1.29	1.28	1.20	1.11	1.56	1.06	1.01	.72
1.11	.94	1.01	1.26	.19	1.20	1.12	1.38	1.00	1.08	.85
1.50	1.32	1.87	1.30	.17	1.14	1.12	1.19	.79	.65	1.04
1.56	.72	.82	.81	.14	1.24	.91	1.63	.94	1.26	.98
.58	1.43	1.40	1.49	.14	1.68	1.85	1.40	1.36	1.25	1.20
1.07	1.22	1.42	2.10		1.48	1.53	1.80	1.35	2.02	1.21
1.55	1.75	1.78	1.60		1.52	1.30	1.40	1.65	1.05	1.32
.45	1.70	1.80	.35		1.15	1.25	1.00	.90	.98	.85
1.70	1.35	1.05	.23		.85	1.25	1.80	.70	1.35	.65
1.36	1.00	1.04			.92	.91	.50	.65		
.94	.92	1.01					.15	.20		
.40	.62	.49								
.23	.41	.29								
Total heights.										
16.18	15.06	16.38	12.13	15.30	14.42	14.81	15.55	12.35	13.25	12.05

Measurements of growth of culms of *Gigantochloa levis* are given in Table 10. This species sends up its shoots in general later than do *Bambusa spinosa* and *Bambusa vulgaris*. Measurements were started on a few shoots which had commenced to develop on June 5, but only one of these shoots reached maturity and then produced only a small culm. The measurements of this individual have not been included in our table on account of the small size attained. In general the shoots did not commence to develop in 1915 until July. The date of the first measurements of culms given in Table 9 is July 3. Except for the later development of the culms, *Gigantochloa levis* shows the same general growth phenomena as *Bambusa spinosa* and *Bambusa vulgaris*, but the rates of growth, according to our tables, are intermediate.

TABLE 10.—*Growth of culms of Gigantochloa levis, at Division of Investigation, Bureau of Forestry, Los Baños, Laguna, Philippine Islands. Data from report by Ranger Oro.*

<table>
<tr><th colspan="9">Height in meters at first measurement.</th></tr>
<tr><td>.09</td><td>.05</td><td>.10</td><td>.09</td><td>.24</td><td>.10</td><td>.20</td><td>.15</td><td>.37</td></tr>
<tr><th colspan="9">Growth in meters during successive weeks.</th></tr>
<tr><td></td><td>.08</td><td>.04</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td>.02</td><td>.05</td><td></td><td></td><td></td><td></td><td></td><td>.14</td></tr>
<tr><td>.08</td><td>.05</td><td>.07</td><td>.08</td><td>.12</td><td>.01</td><td></td><td></td><td>.33</td></tr>
<tr><td>.07</td><td>.02</td><td>.11</td><td>.11</td><td>.16</td><td>.03</td><td>.13</td><td></td><td>.88</td></tr>
<tr><td>.20</td><td>.08</td><td>.11</td><td>.10</td><td>.82</td><td>.01</td><td>.30</td><td>.01</td><td>1.14</td></tr>
<tr><td>.16</td><td>.01</td><td>.23</td><td>.18</td><td>.88</td><td>.01</td><td>.49</td><td>.10</td><td>1.80</td></tr>
<tr><td>.58</td><td>.23</td><td>.60</td><td>.49</td><td>1.21</td><td>.01</td><td>1.14</td><td>.07</td><td>2.04</td></tr>
<tr><td>.92</td><td>.27</td><td>1.13</td><td>.92</td><td>1.58</td><td>.01</td><td>1.69</td><td>.14</td><td>1.57</td></tr>
<tr><td>.68</td><td>.64</td><td>1.16</td><td>1.05</td><td>1.19</td><td>.33</td><td>1.00</td><td>.26</td><td>1.30</td></tr>
<tr><td>1.29</td><td>1.12</td><td>1.22</td><td>.98</td><td>1.48</td><td>.22</td><td>1.19</td><td>.72</td><td>1.15</td></tr>
<tr><td>2.73</td><td>1.11</td><td>1.81</td><td>1.63</td><td>.99</td><td>.77</td><td>1.81</td><td>1.45</td><td>.75</td></tr>
<tr><td>1.88</td><td>1.01</td><td>1.55</td><td>1.90</td><td>2.28</td><td>1.80</td><td>1.85</td><td>1.55</td><td>1.41</td></tr>
<tr><td>.87</td><td>2.16</td><td>1.97</td><td>1.67</td><td>1.20</td><td>1.90</td><td>1.57</td><td>2.35</td><td>1.09</td></tr>
<tr><td>1.75</td><td>2.60</td><td>1.65</td><td>1.35</td><td>1.85</td><td>2.70</td><td>.99</td><td>2.10</td><td>.63</td></tr>
<tr><td>1.49</td><td>1.05</td><td>1.00</td><td>1.45</td><td>.92</td><td>2.00</td><td>.70</td><td>1.05</td><td></td></tr>
<tr><td>.78</td><td>1.11</td><td>.50</td><td>.90</td><td>.57</td><td>1.47</td><td>.30</td><td>1.20</td><td></td></tr>
<tr><td>.33</td><td>.94</td><td>.30</td><td>.50</td><td>.22</td><td>.92</td><td></td><td>.95</td><td></td></tr>
<tr><td></td><td>.50</td><td>.20</td><td>.16</td><td></td><td>.50</td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td>.16</td><td></td><td></td><td>.20</td><td></td><td></td><td></td></tr>
<tr><th colspan="9">Total heights.</th></tr>
<tr><td>13.90</td><td>13.00</td><td>13.96</td><td>13.56</td><td>14.71</td><td>12.49</td><td>13.36</td><td>12.10</td><td>14.60</td></tr>
</table>

TABLE 10.—*Growth of culms of Gigantochloa levis, etc.*—Continued.

Height in meters at first measurement.								
.21	.22	.23	.72	.24	.22	.31	.11	.13
Growth in meters during successive weeks.								
			.68					
.09			1.10					
.13			1.68	.19	.33			
.20	.02	.08	1.60	.10	.74	.57	.11	.02
.31	.01	.35	2.18	.09	1.06	.99	.11	.11
.69	.02	1.16	1.61	.02	1.41	1.46	.11	.12
1.31	.13	1.20	.59	.86	1.66	1.66	.27	.21
1.76	.18	1.90	.50	1.10	1.38	2.00	.64	.51
1.55	.60	1.60	2.09	1.52	1.50	1.33	1.20	1.20
2.05	1.17	1.80	1.20	2.26	1.90	1.98	1.17	1.10
1.93	1.35	1.96	.93	1.49	1.40	2.36	1.43	2.27
2.27	2.00	.77	.12	2.03	1.15	1.34	1.66	2.03
1.15	2.00	1.75		1.40	.95	.90	1.49	1.70
1.20	2.75	1.35		1.30	.60	.70	1.80	1.20
.78	1.35	.88		.93	.50	.30	1.35	1.20
.27	1.15	.26		.64	.30	.30	.45	.78
	.75							.18
	.40							
Total heights.								
15.90	14.10	15.24	15.00	13.67	15.10	16.20	11.90	12.76

Osmaston[1] found that *Dendrocalamus giganteus* at Dehra Dun, India, began to develop new culms toward the middle of the rainy season and that these did not complete their growth until two months after the rains normally ceased. It would appear from this that all bamboos do not behave alike in respect to their season of growth.

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[1] Osmaston, B. B., Rate of Growth of Bamboos, *Indian Forester*, Vol. 44 (1918), page 52.

Ranger Mabesa has made counts of the number of shoots produced in one season on two areas of *Schizostachyum lumampao*, each area consisting of 100 square meters. The two areas together contained 340 canes and produced 35 shoots, or 10 per cent of the original number. All canes were cut from two smaller-sized plots in May, 1917, and the number of new canes counted in November, 1917. These two plots originally contained 221 canes. After the clearing they sent up a large number of shoots about the size of a lead pencil and 10 usable canes, which is only 4.5 per cent of the original number. This would indicate that it requires some years for this bamboo to regain its original density when once completely cut-over.

COST OF HARVESTING AND PRICES

Data on the cost of harvesting were collected during the year 1916 on the College of Agriculture farm at Los Baños, Laguna. One man was employed for a total of 91 days, during which time 1,000 canes of *Bambusa spinosa* were harvested, an average of 11 canes per day. The cost of labor was 80 centavos per day, making the total cost of harvesting 1,000 canes 72.80 pesos or an average per cane of 7.28 centavos. In the same locality these canes sold at 4 pesos per dozen.

Bamboo sold in Manila is floated down the river from the country behind or across Manila Bay. In Manila the present prices for canes in the river are: First-class canes, 32 pesos per hundred; second-class canes, 27 pesos per hundred; and third-class canes, from 18 to 20 pesos per hundred. The cost of floating bamboo to Manila is very small, as rafts containing large numbers of canes can be operated by a very few men.

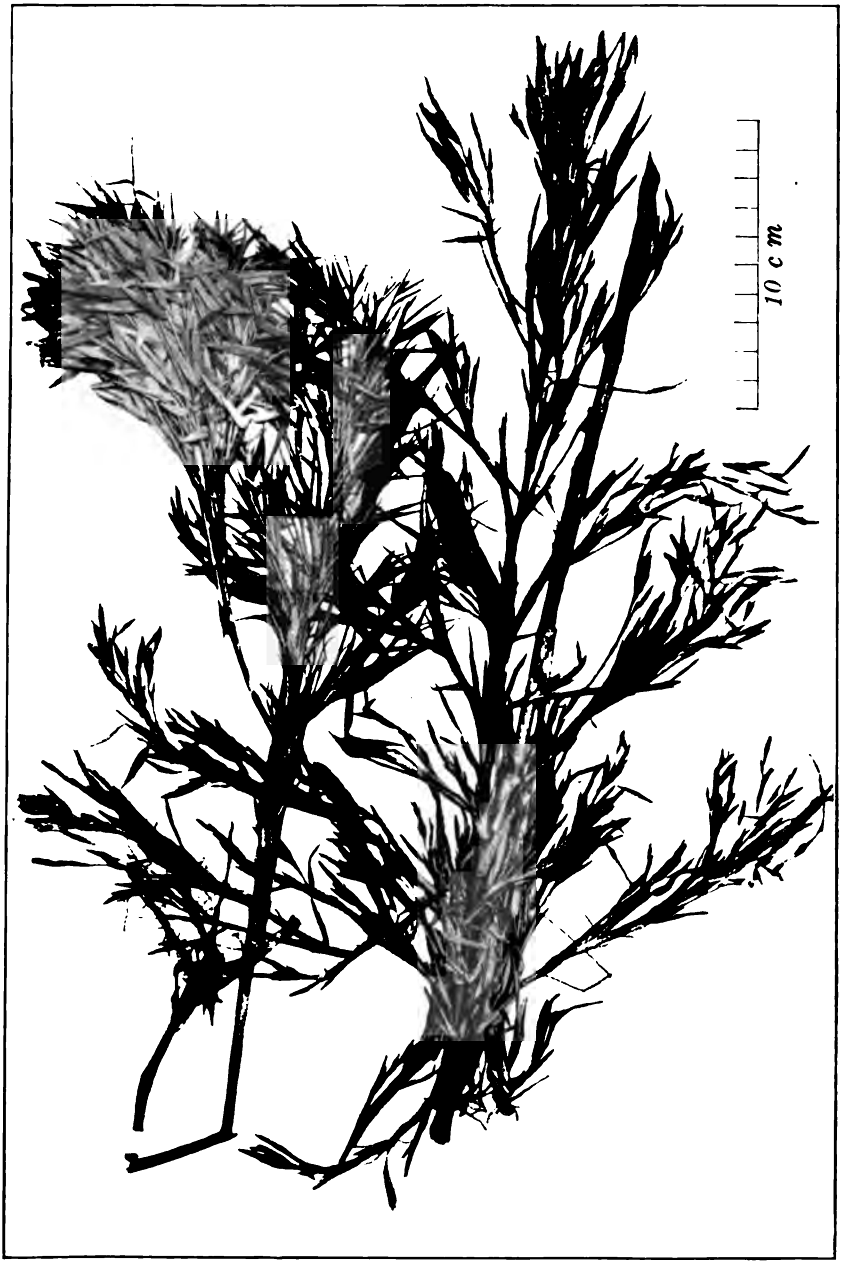

PLATE II. ARUNDINARIA NIITAKAYAMENSIS HAYATA.

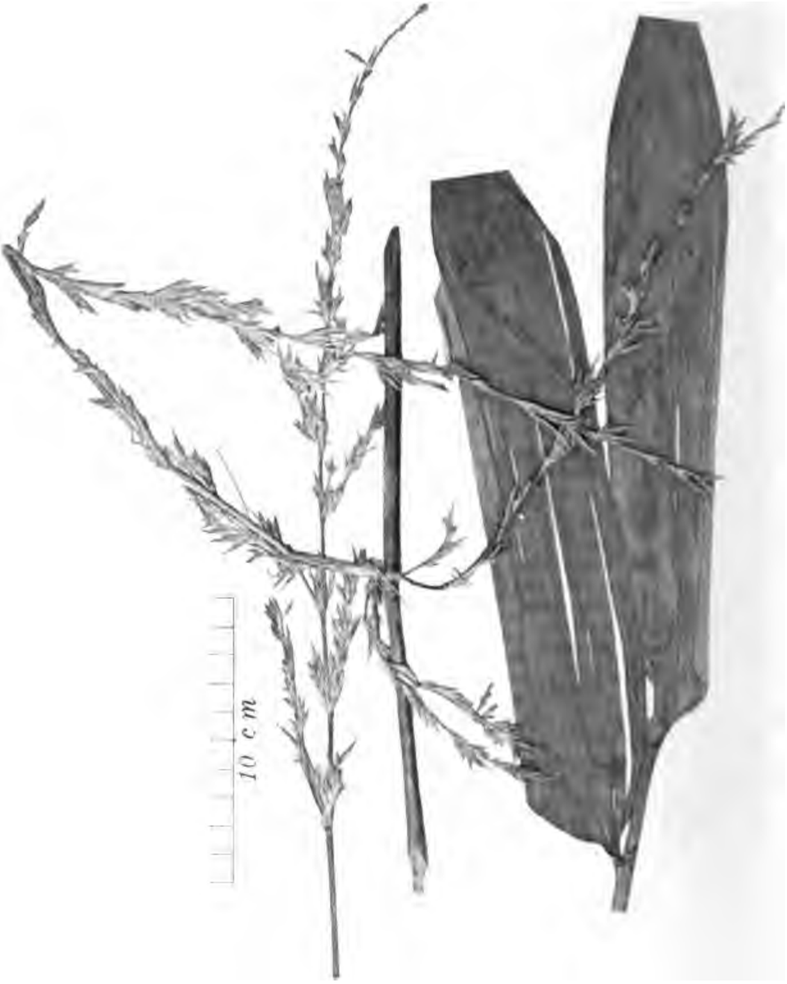

PLATE III. BAMBUSA CORNUTA MUNRO.

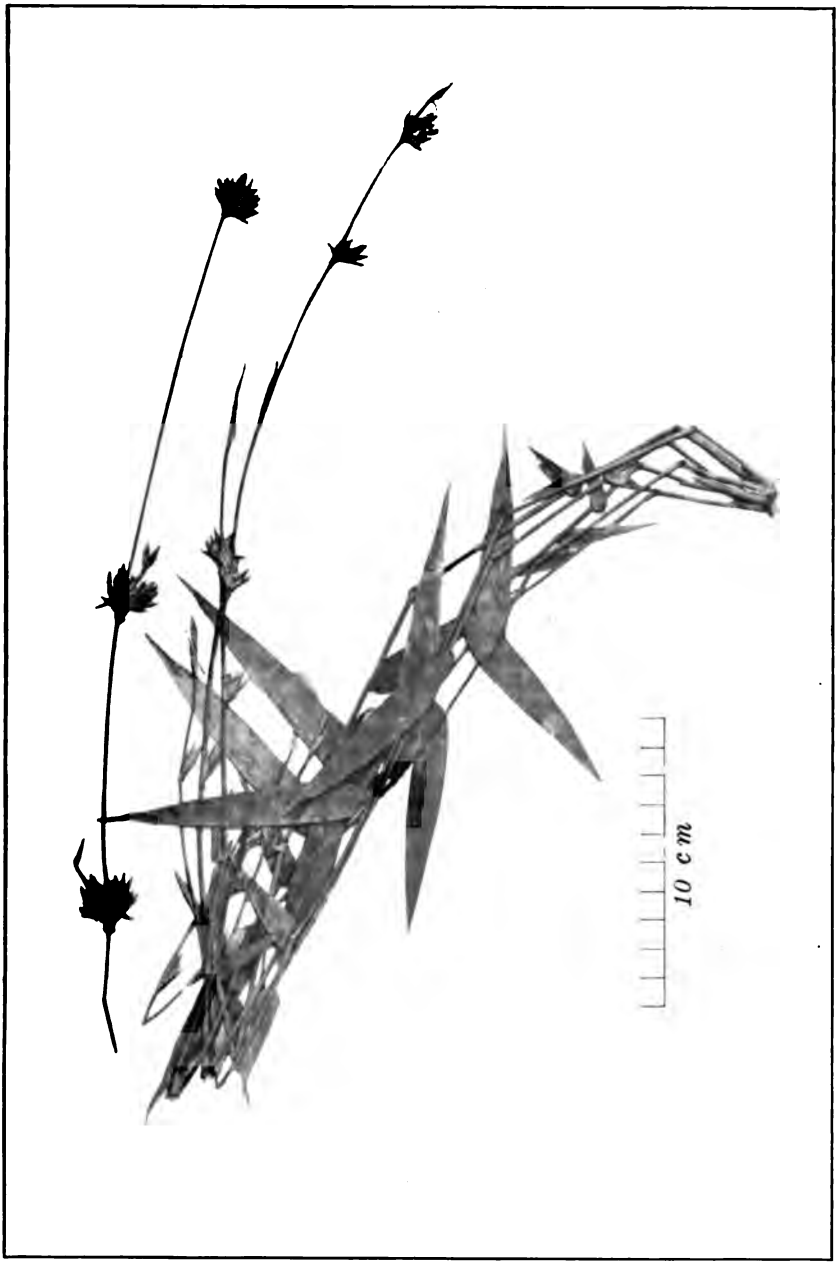

PLATE IV. BAMBUSA MERRILLII GAMBLE. TYPE SPECIMEN.

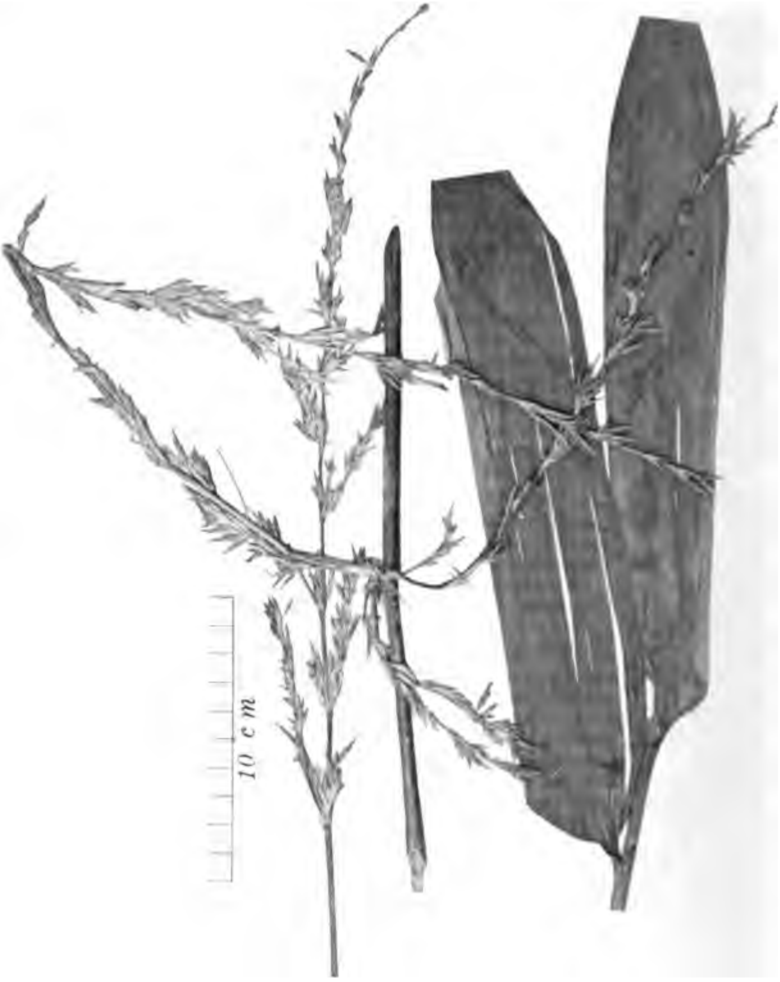

PLATE III. BAMBUSA CORNUTA MUNRO.

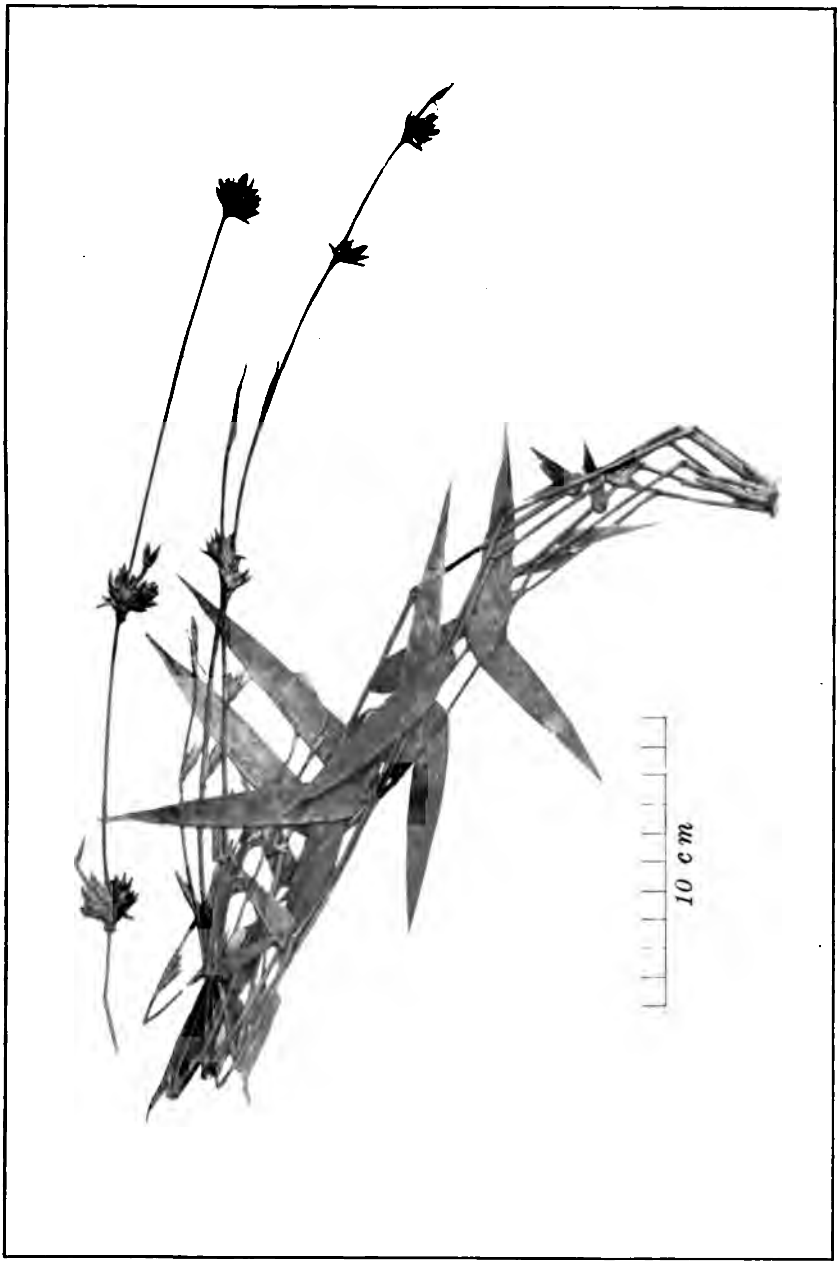

PLATE IV. BAMBUSA MERRILLII GAMBLE. TYPE SPECIMEN.

PLATE V. BAMBUSA SPINOSA ROXB.

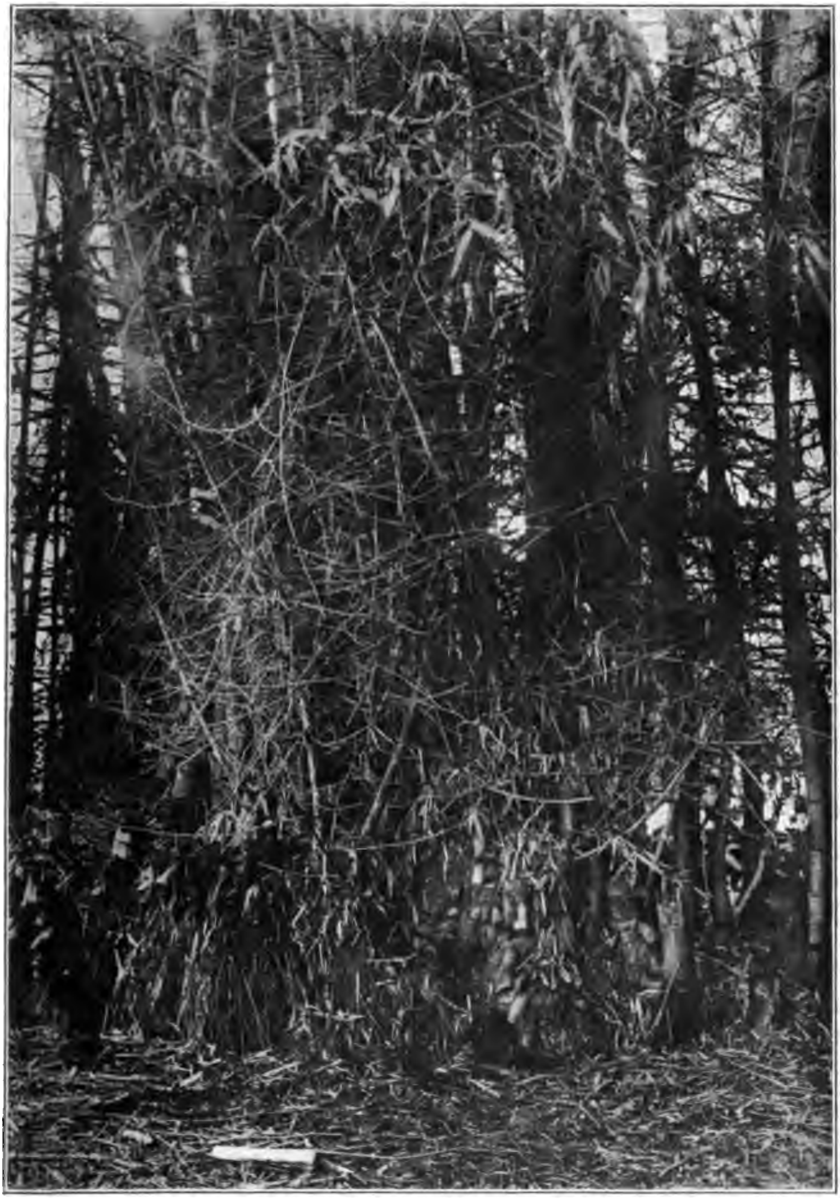

PLATE VI. BAMBUSA SPINOSA ROXB.

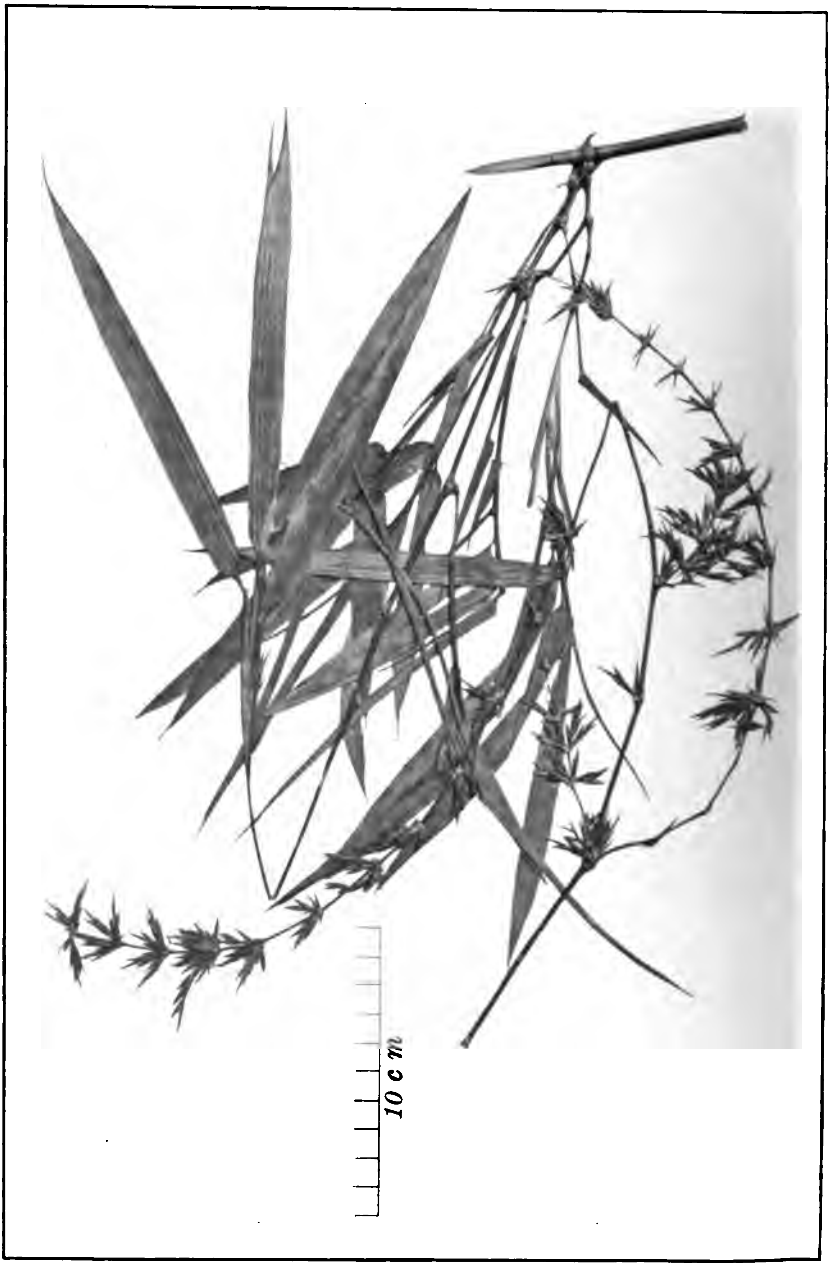

PLATE VII. BAMBUSA SPINOSA ROXB.

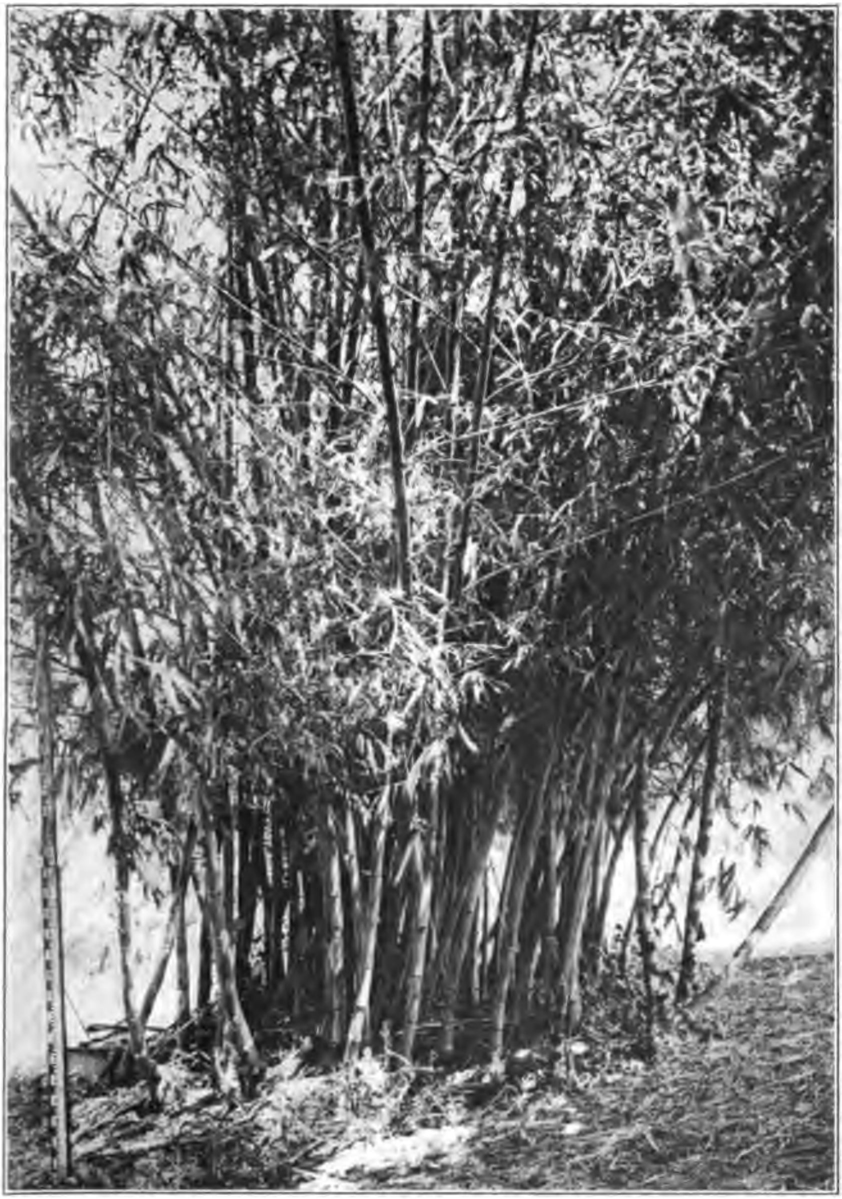

PLATE VIII. BAMBUSA VULGARIS SCHRAD.

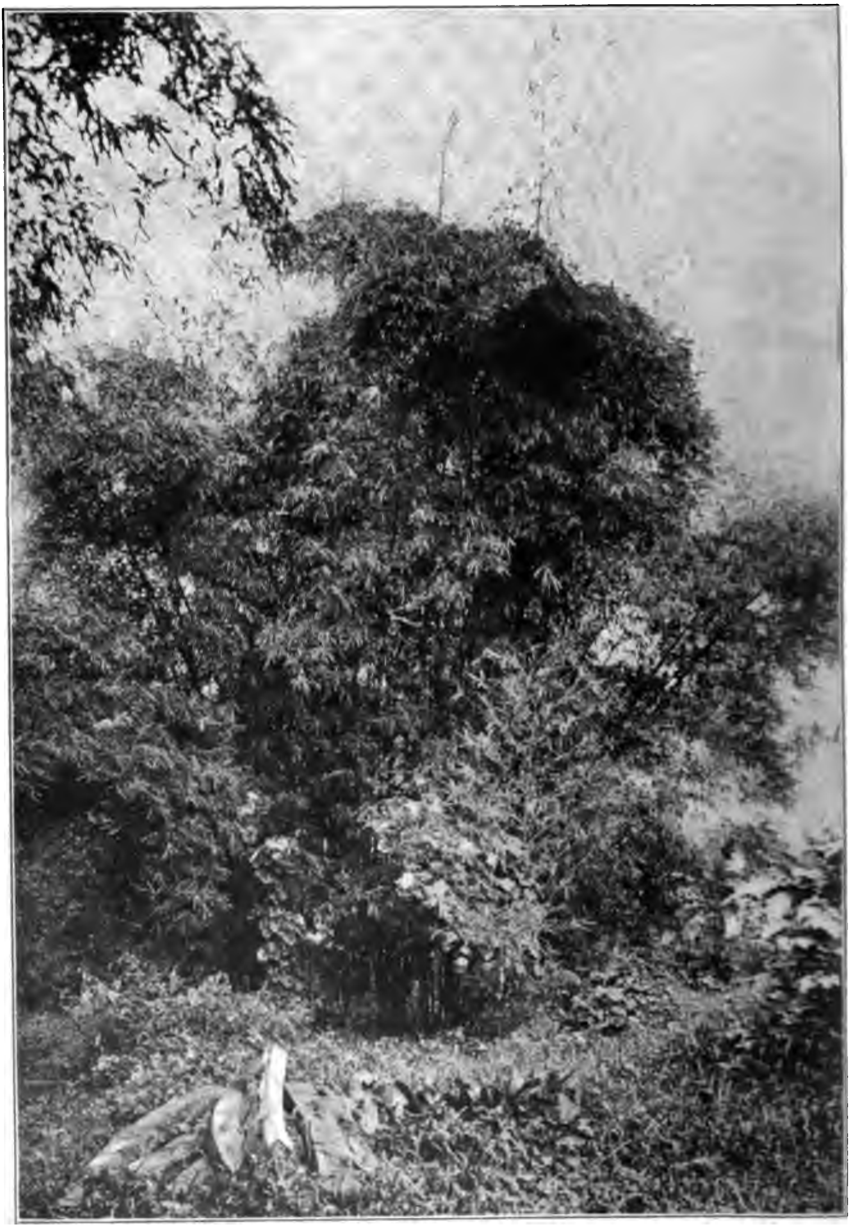

PLATE IX. BAMBUSA VULGARIS SCHRAD.

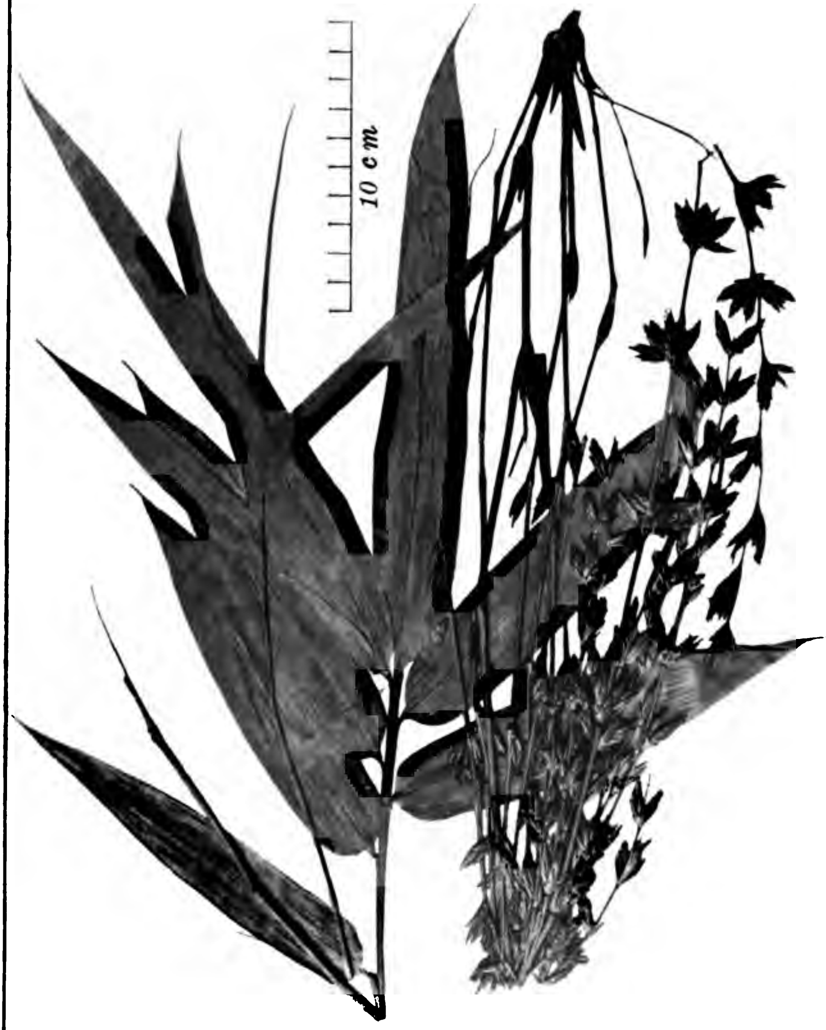

PLATE X. BAMBUSA VULGARIS SCHRAD.

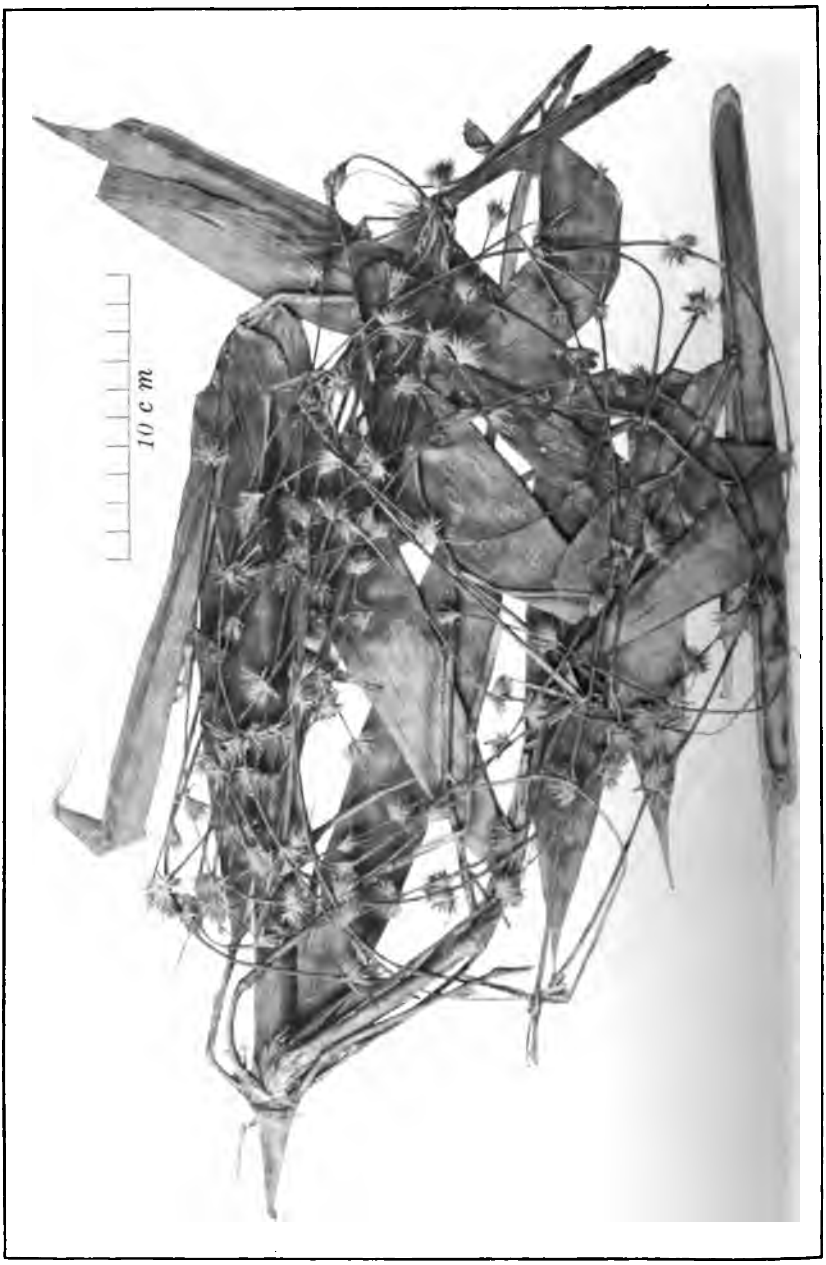

PLATE XI. CEPHALOSTACHYUM MINDORENSE GAMBLE. COTYPE SPECIMEN.

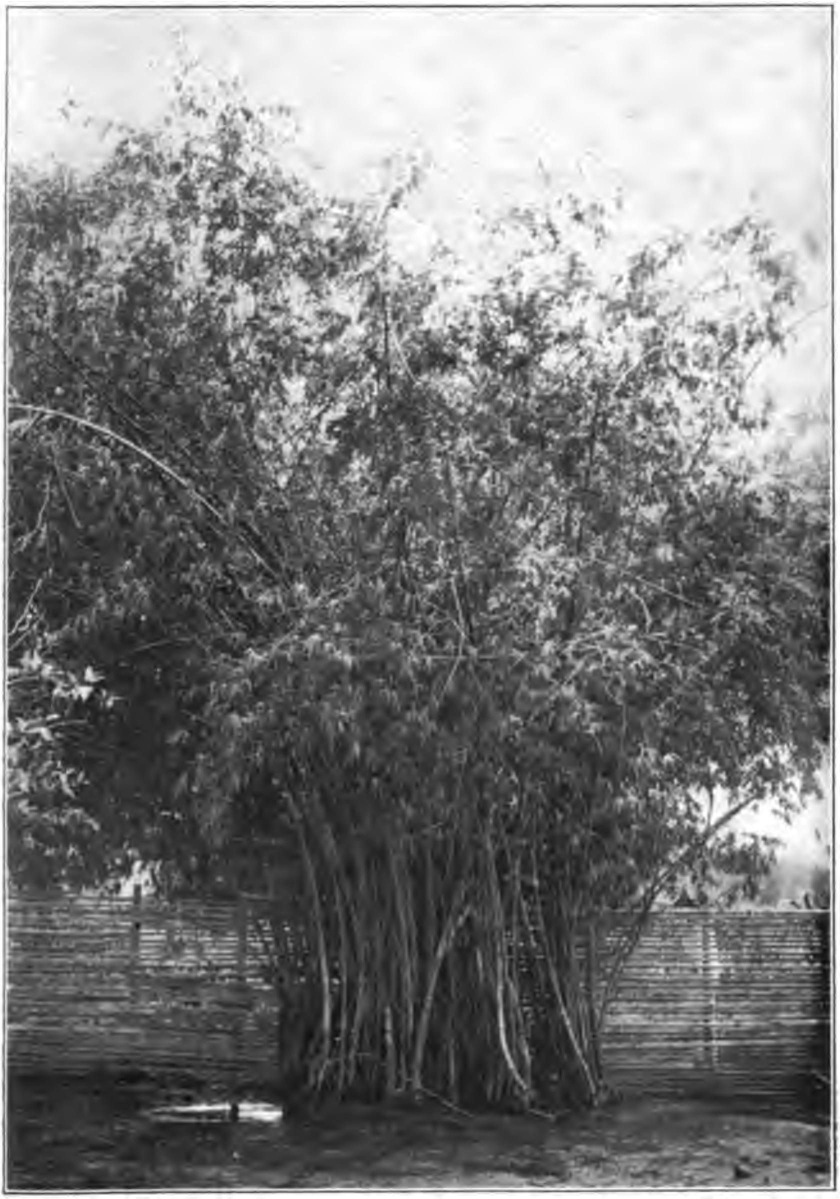

PLATE XII. DENDROCALAMUS MERRILLIANUS ELM.

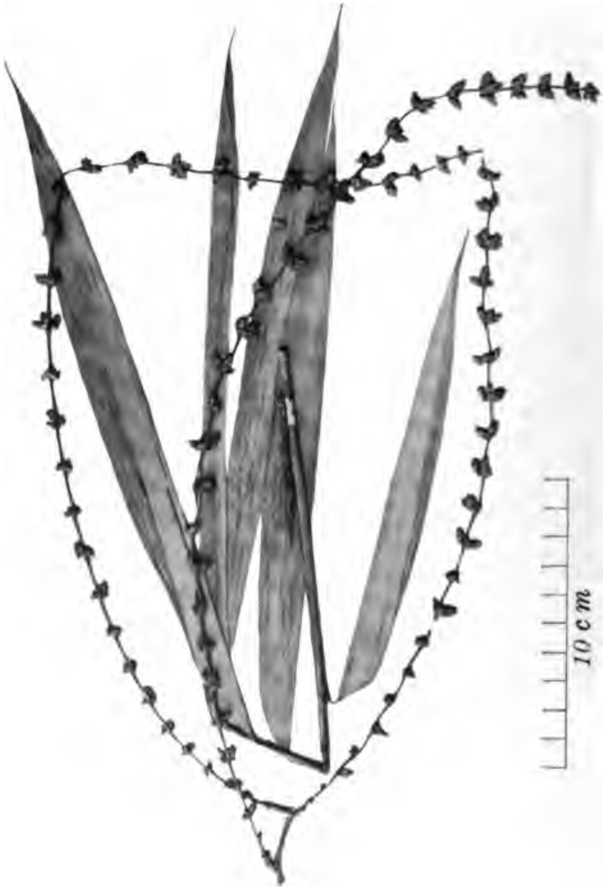

PLATE XIII. DENDROCALAMUS MERRILLIANUS ELM. COTYPE SPECIMEN.

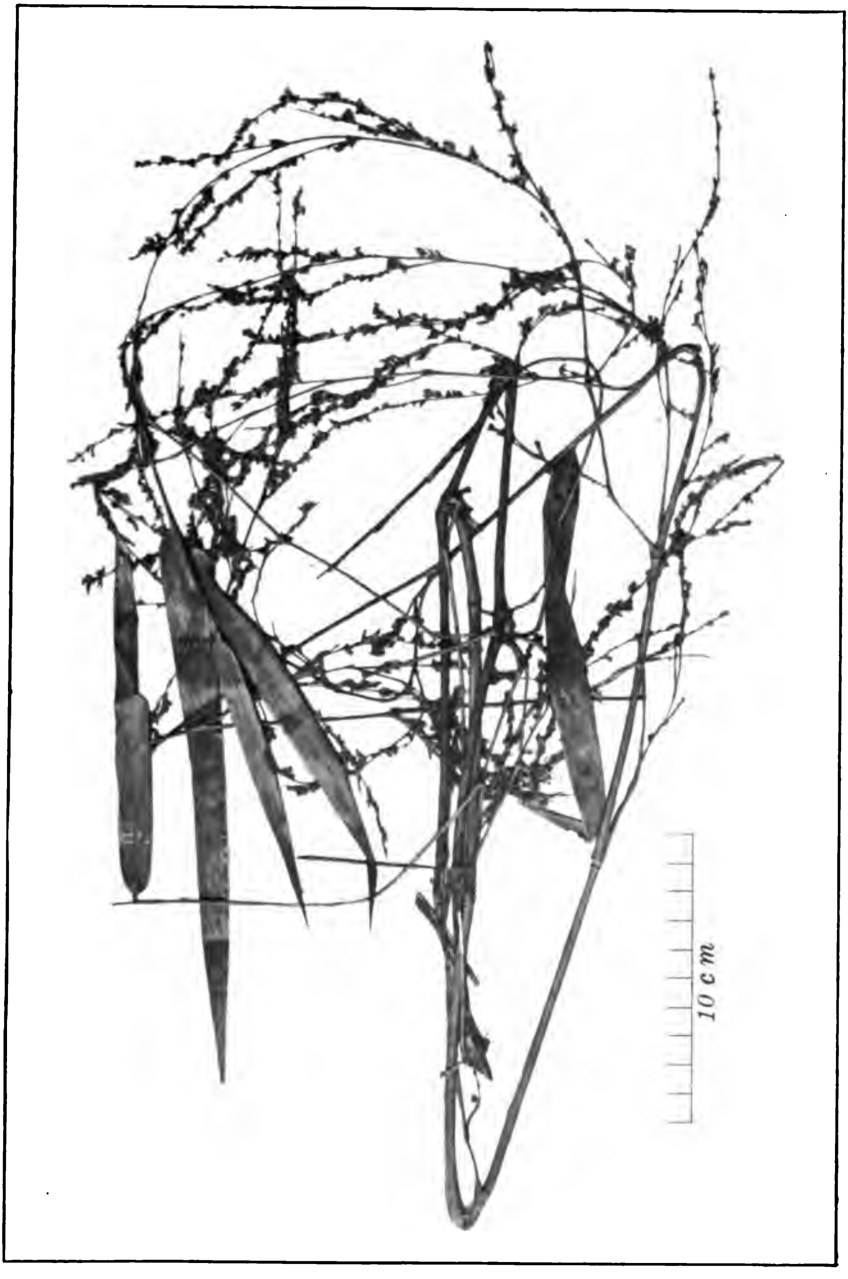

PLATE XIV. DINOCHLOA CILIATA KURZ.

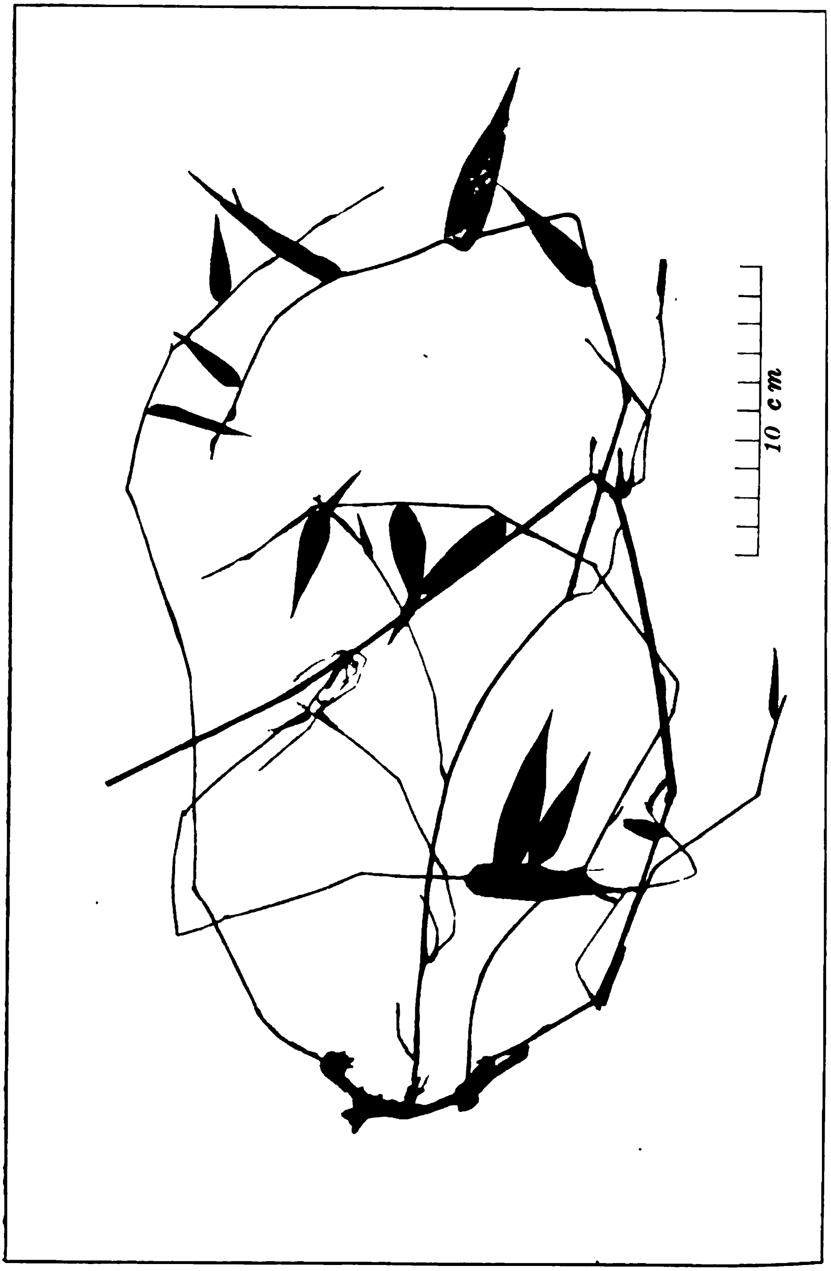

PLATE XV. DINOCHLOA ELMERI GAMBLE.

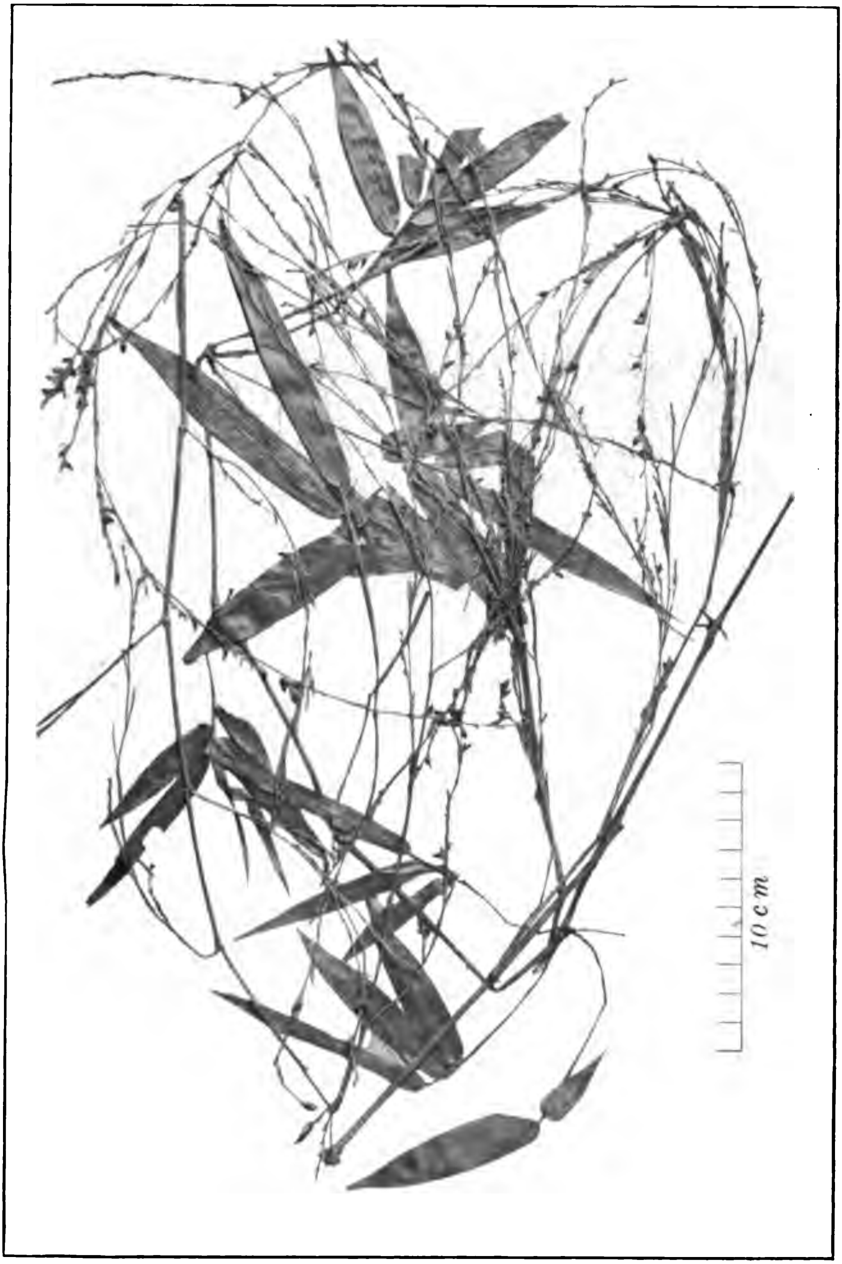

PLATE XVI. DINOCHLOA LUÇONIAE (MUNRO) MERR.

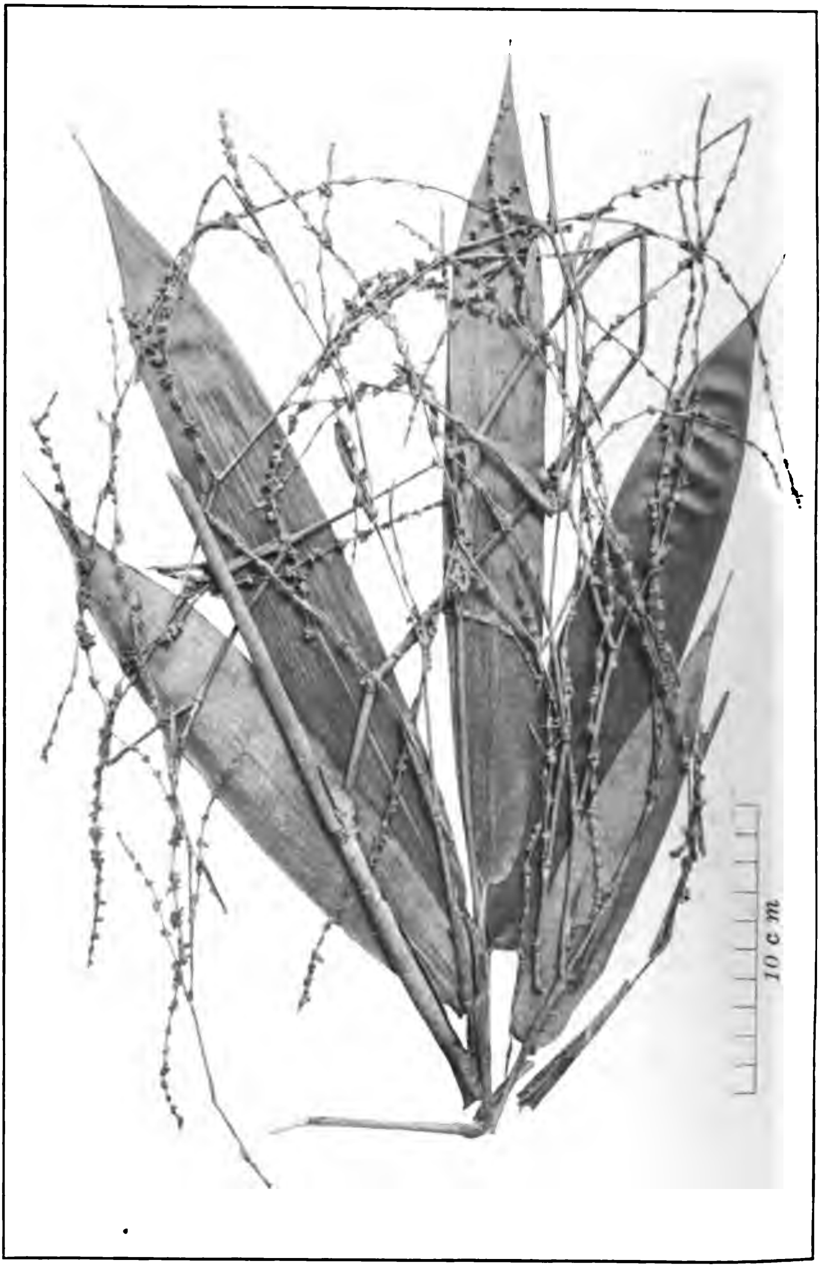

PLATE XVII. DINOCHLOA PUBIRAMEA GAMBLE. TYPE SPECIMEN.

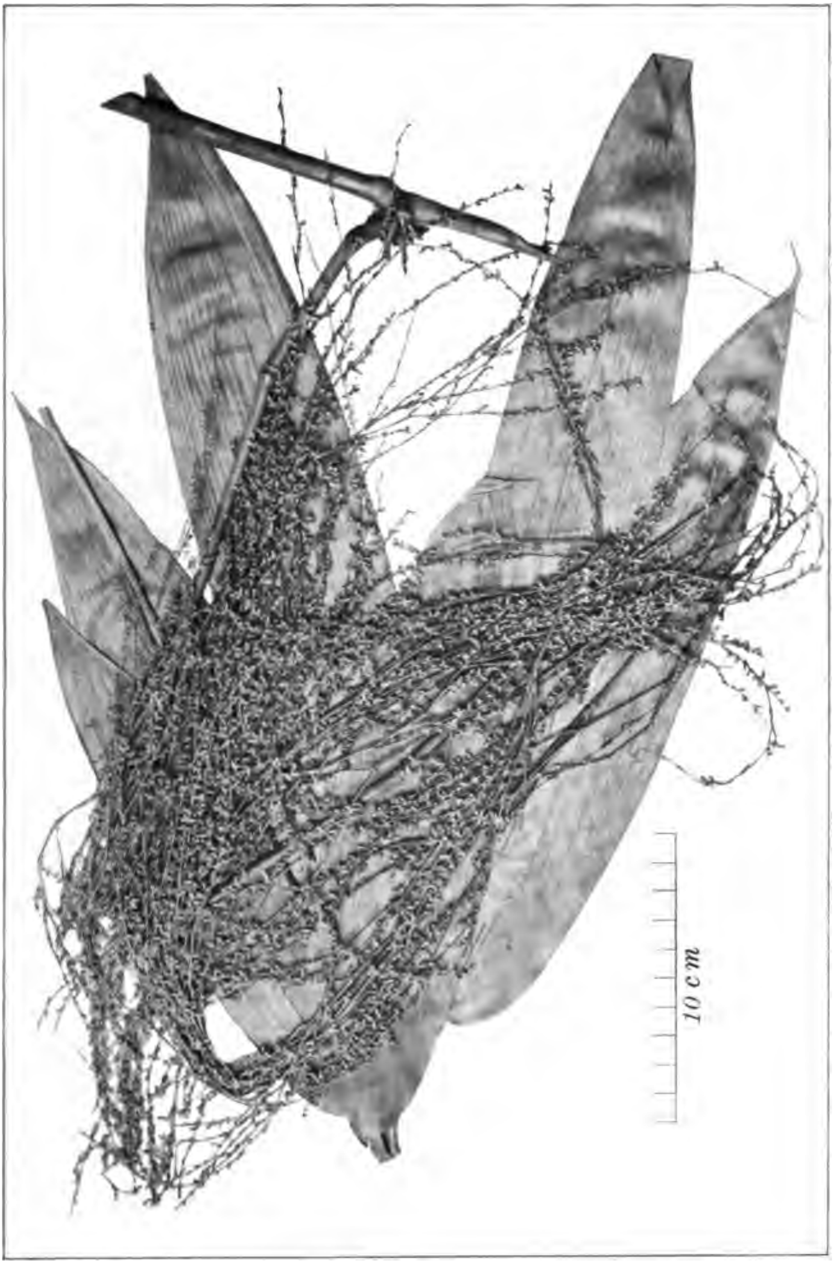

PLATE XVIII. DINOCHLOA SCANDENS O. KUNTZE.

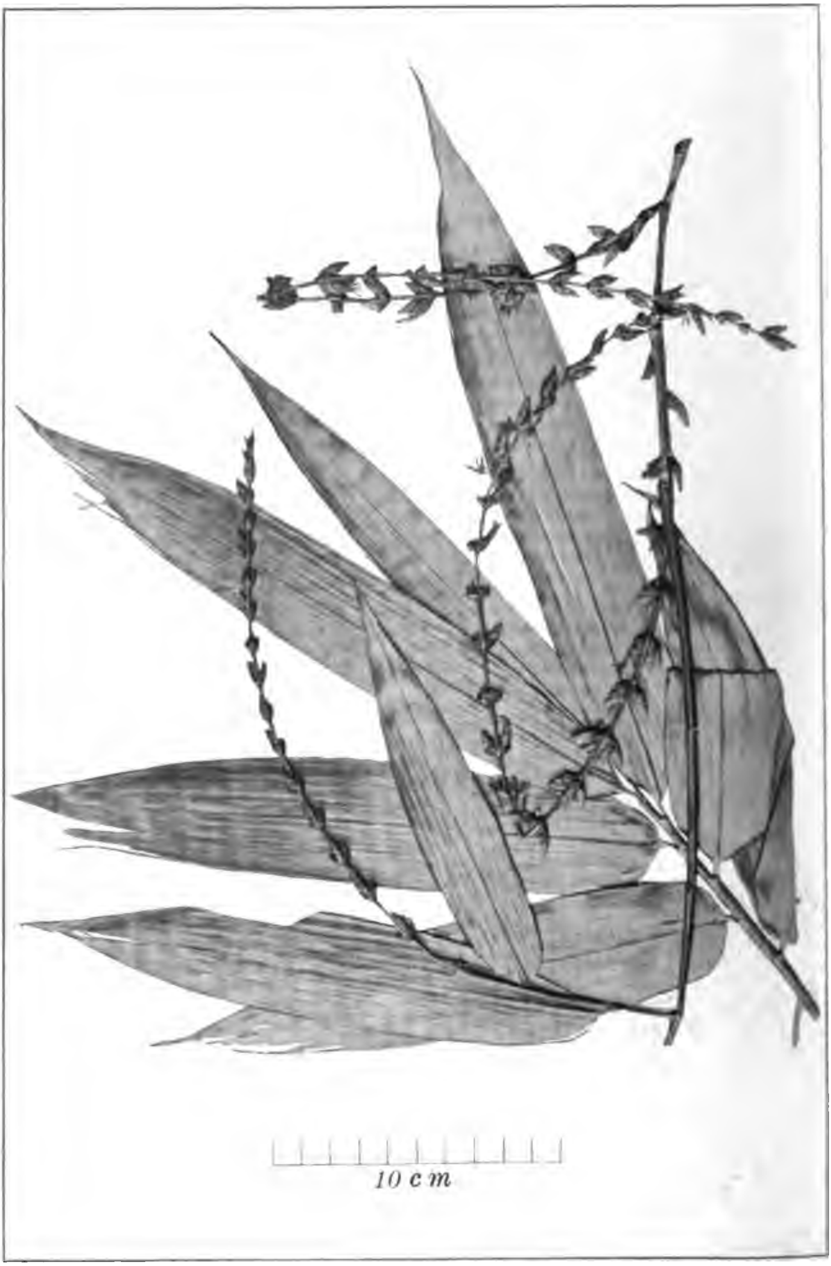

PLATE XIX. GIGANTOCHLOA LEVIS (BLANCO) MERR.

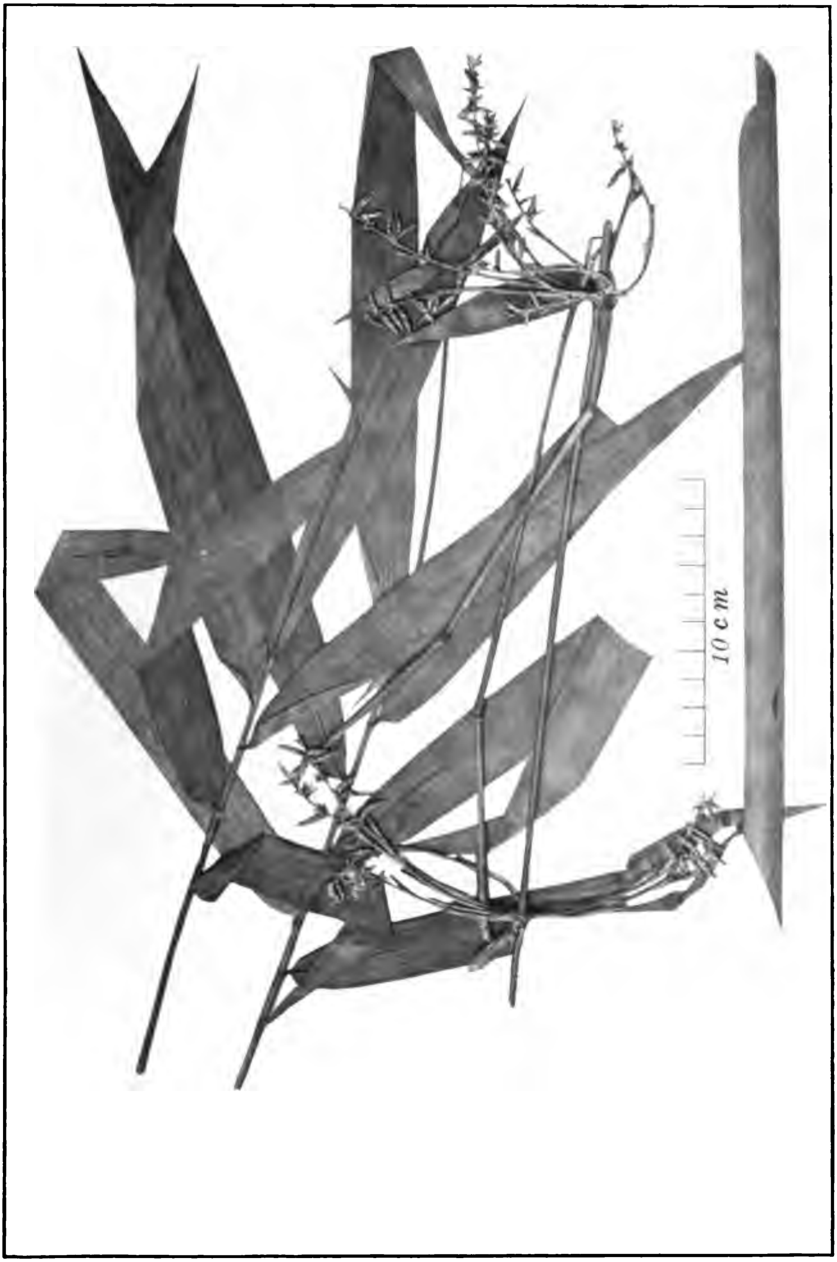

PLATE XX. GUADUA PHILIPPINENSIS GAMBLE. COTYPE SPECIMEN.

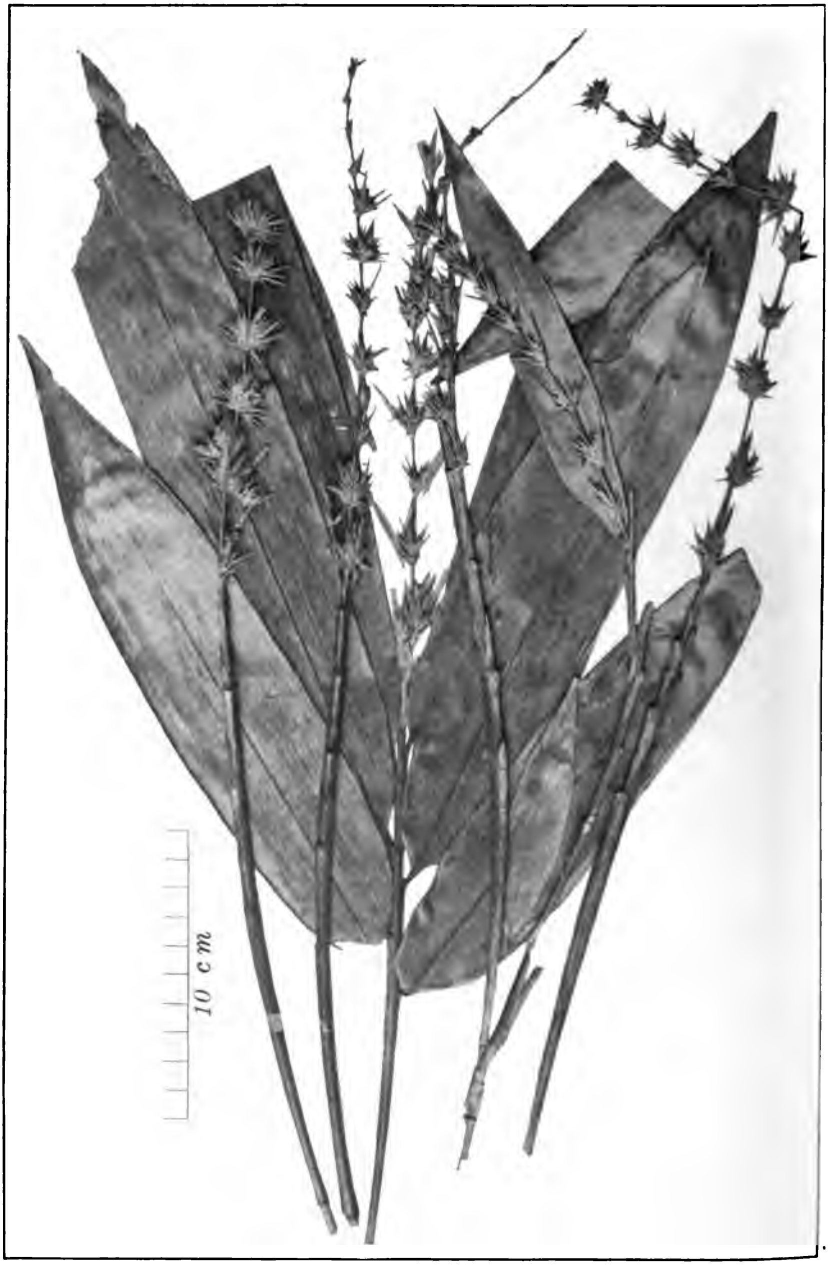

PLATE XXI. SCHIZOSTACHYUM BRACHYCLADUM KURZ.

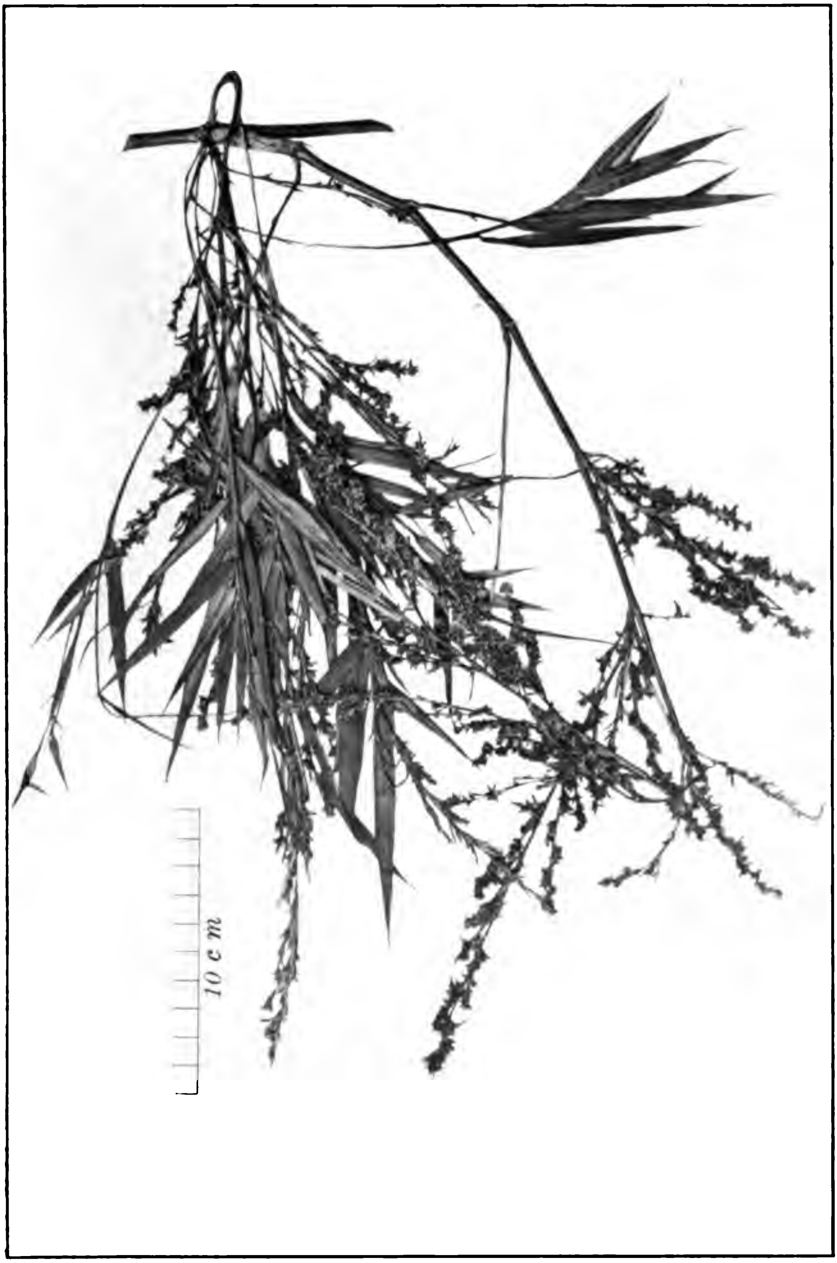

PLATE XXII. SCHIZOSTACHYUM DIELSIANUM (PILGER) MERR.

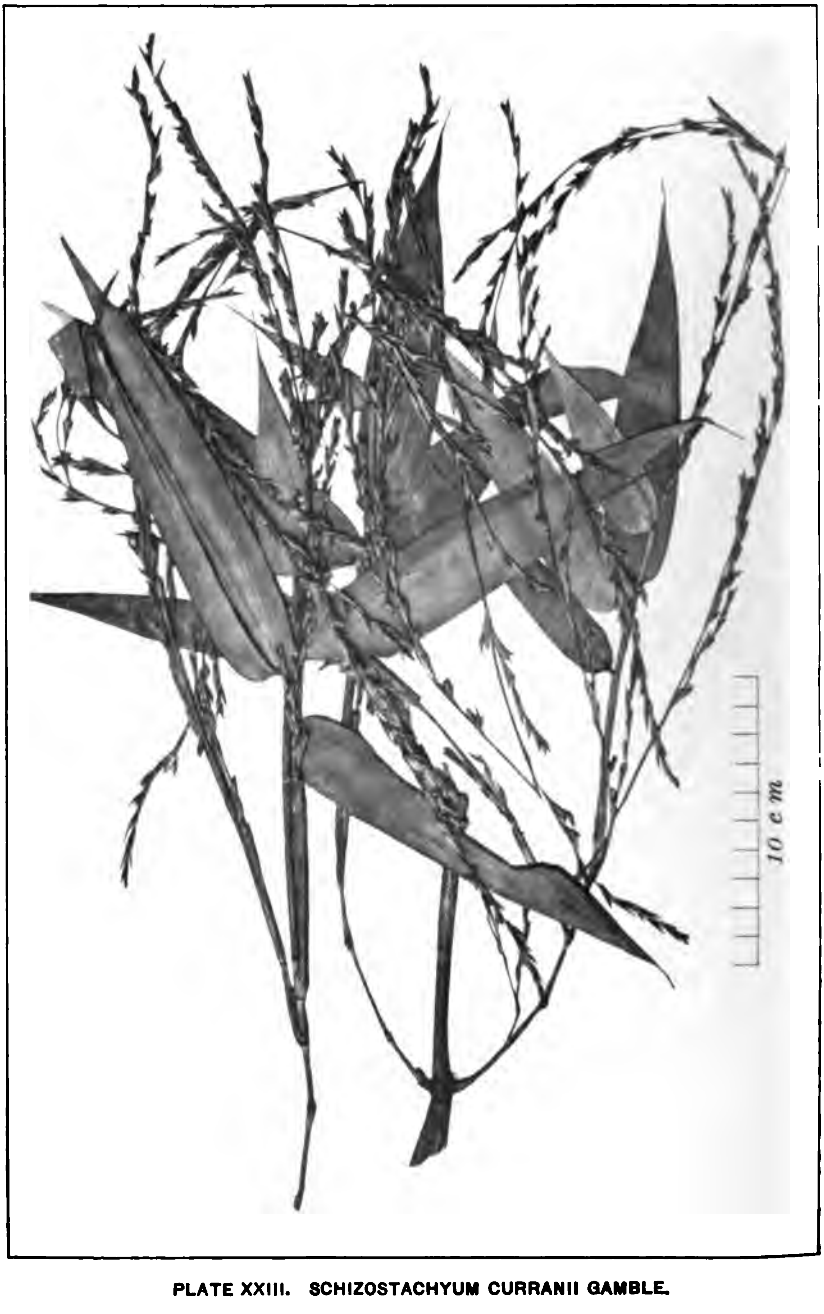

PLATE XXIII. SCHIZOSTACHYUM CURRANII GAMBLE.

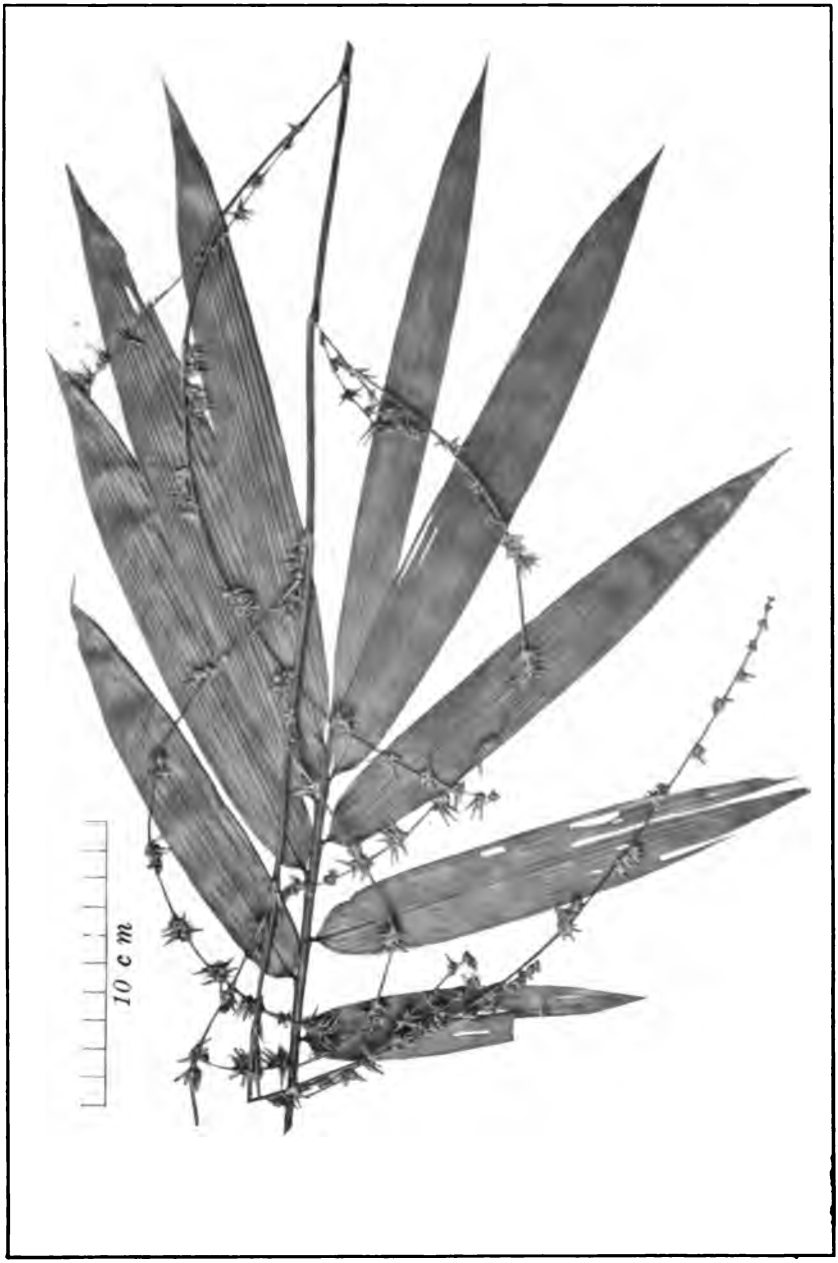

PLATE XXIV. SCHIZOSTACHYUM DIFFUSUM (BLANCO) MERR.

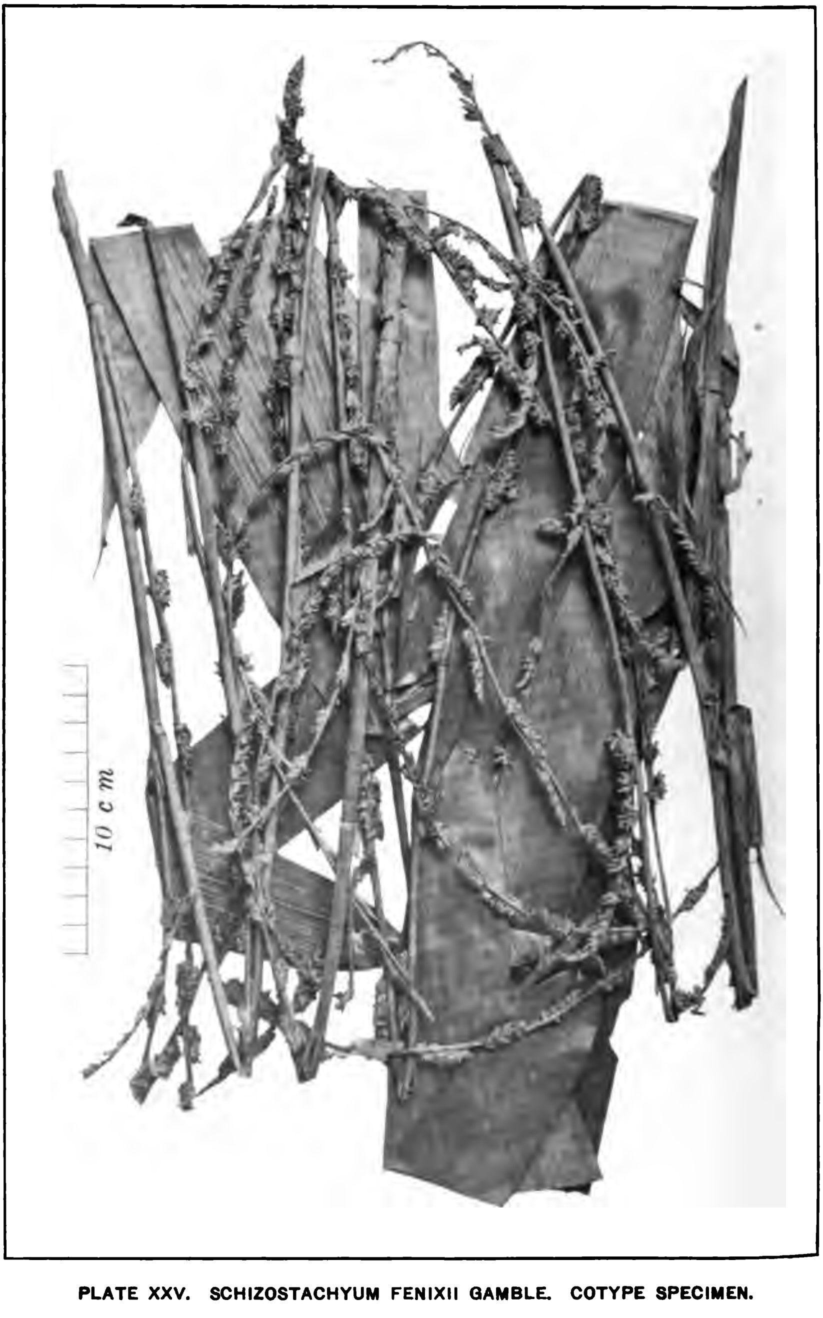

PLATE XXV. SCHIZOSTACHYUM FENIXII GAMBLE. COTYPE SPECIMEN.

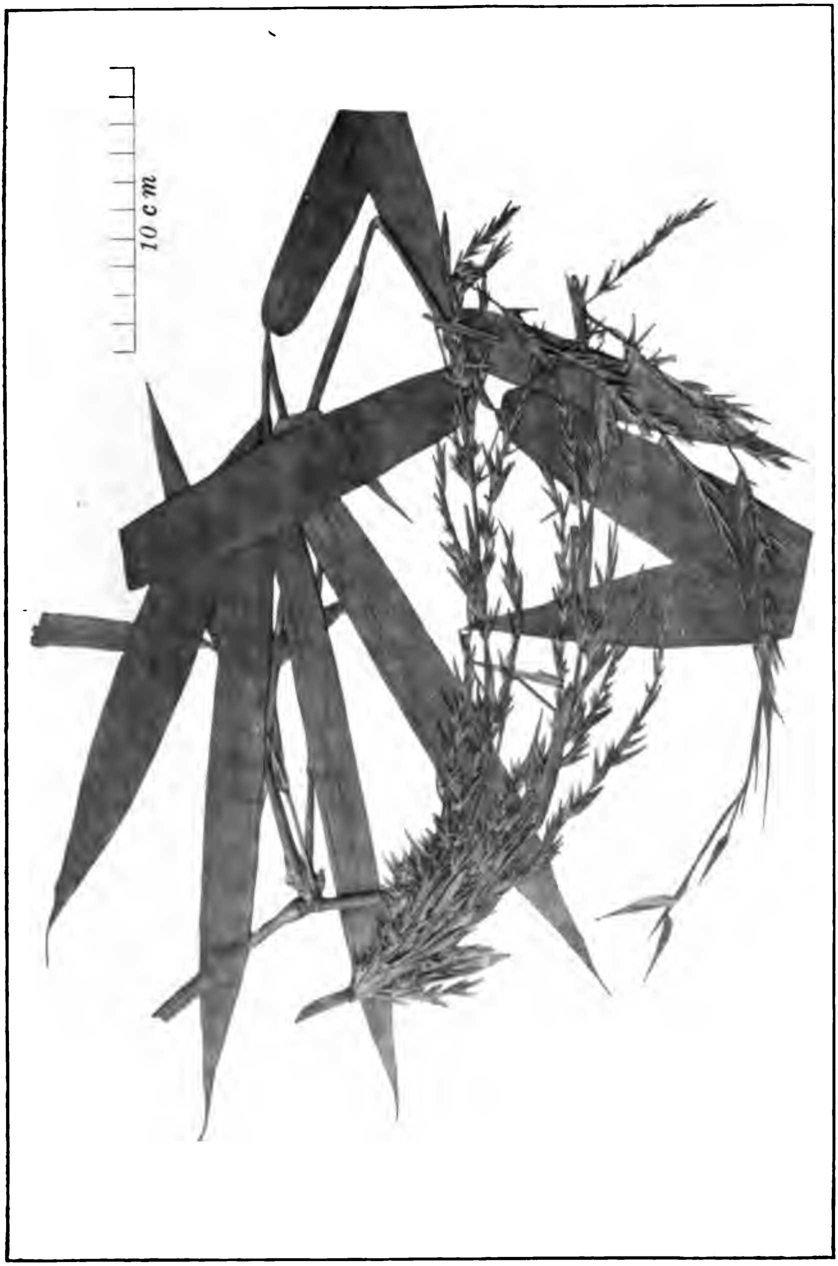

PLATE XXVI. SCHIZOSTACHYUM HIRTIFLORUM HACK. COTYPE SPECIMEN.

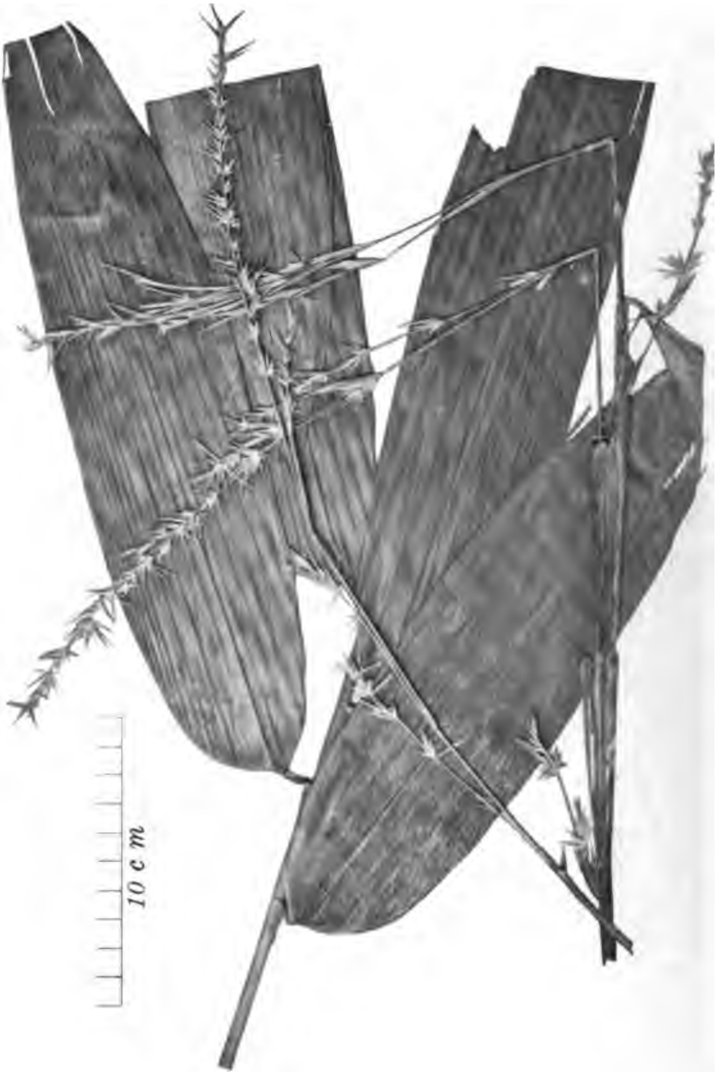

PLATE XXVII. SCHIZOSTACHYUM LIMA (BLANCO) MERR.

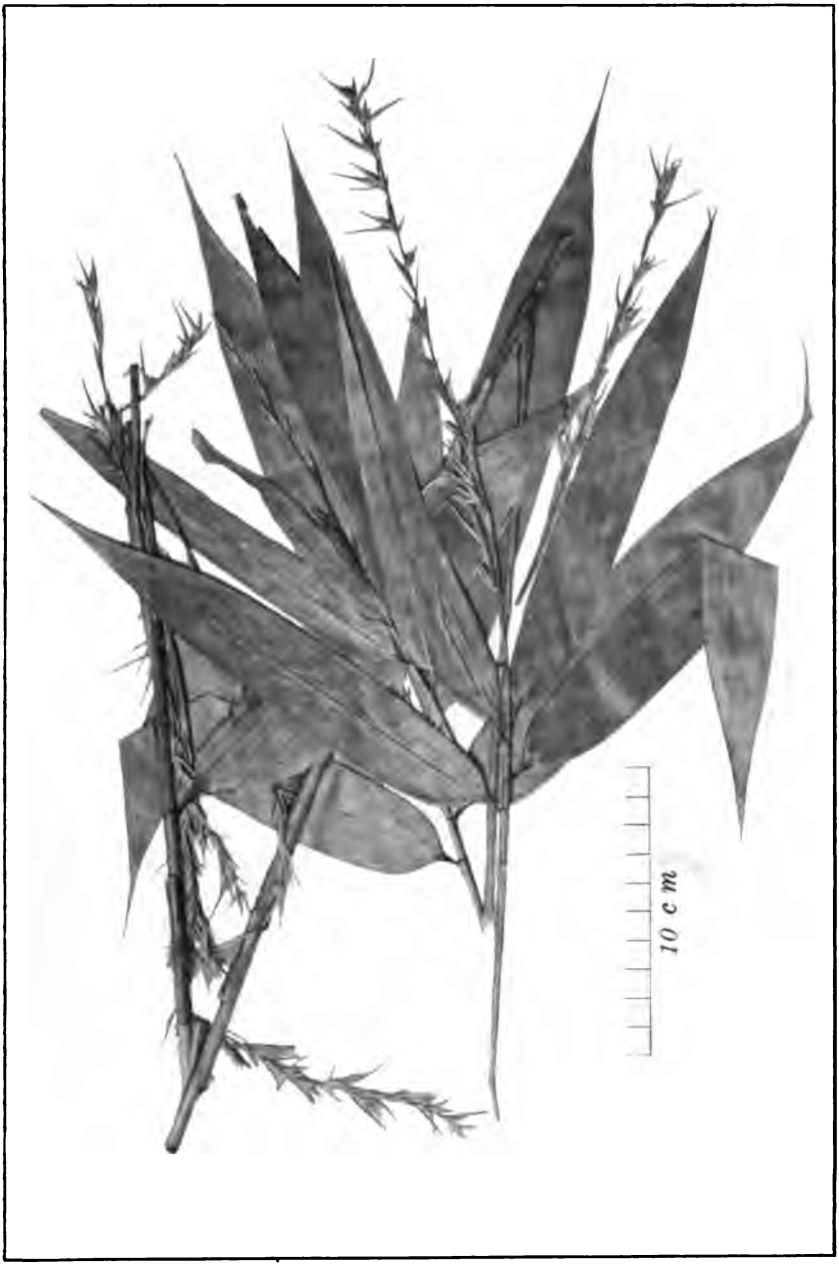

PLATE XXVIII. SCHIZOSTACHYUM LUMAMPAO (BLANCO) MERR.

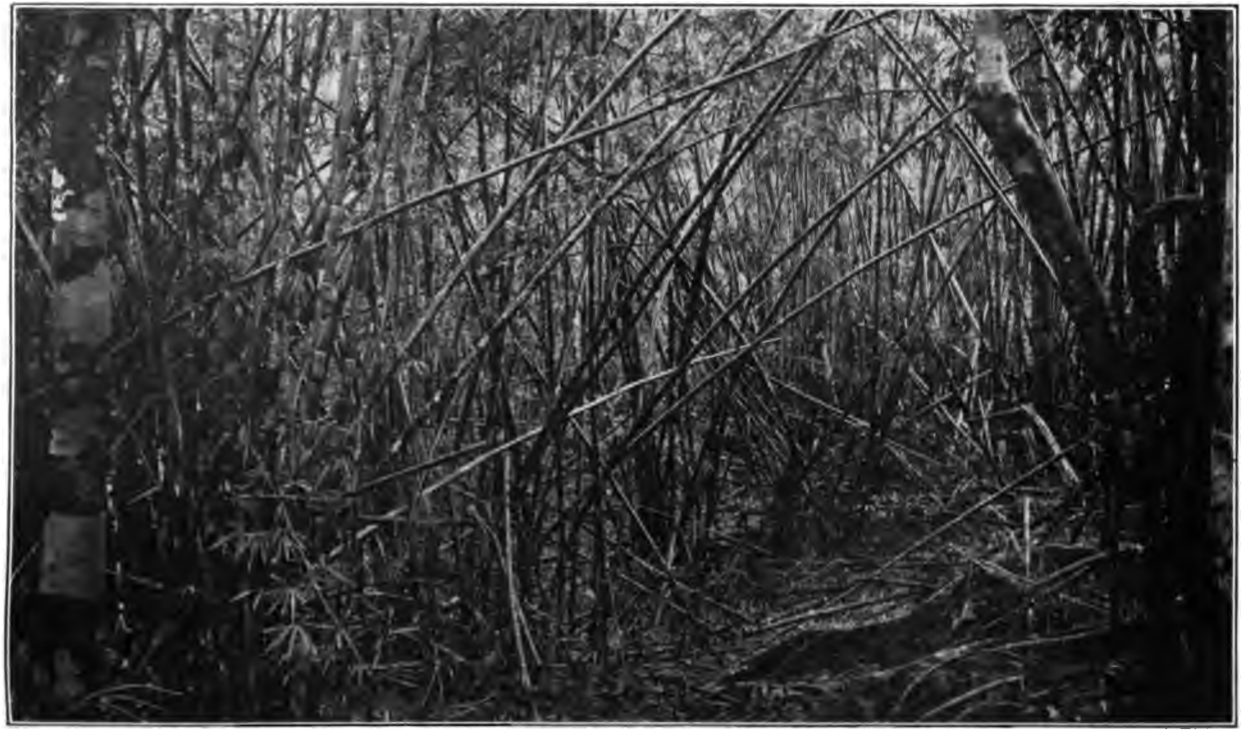

PLATE XXIX. INTERIOR OF MATURE FOREST OF SCHIZOSTACHYUM LUMAMPAO.

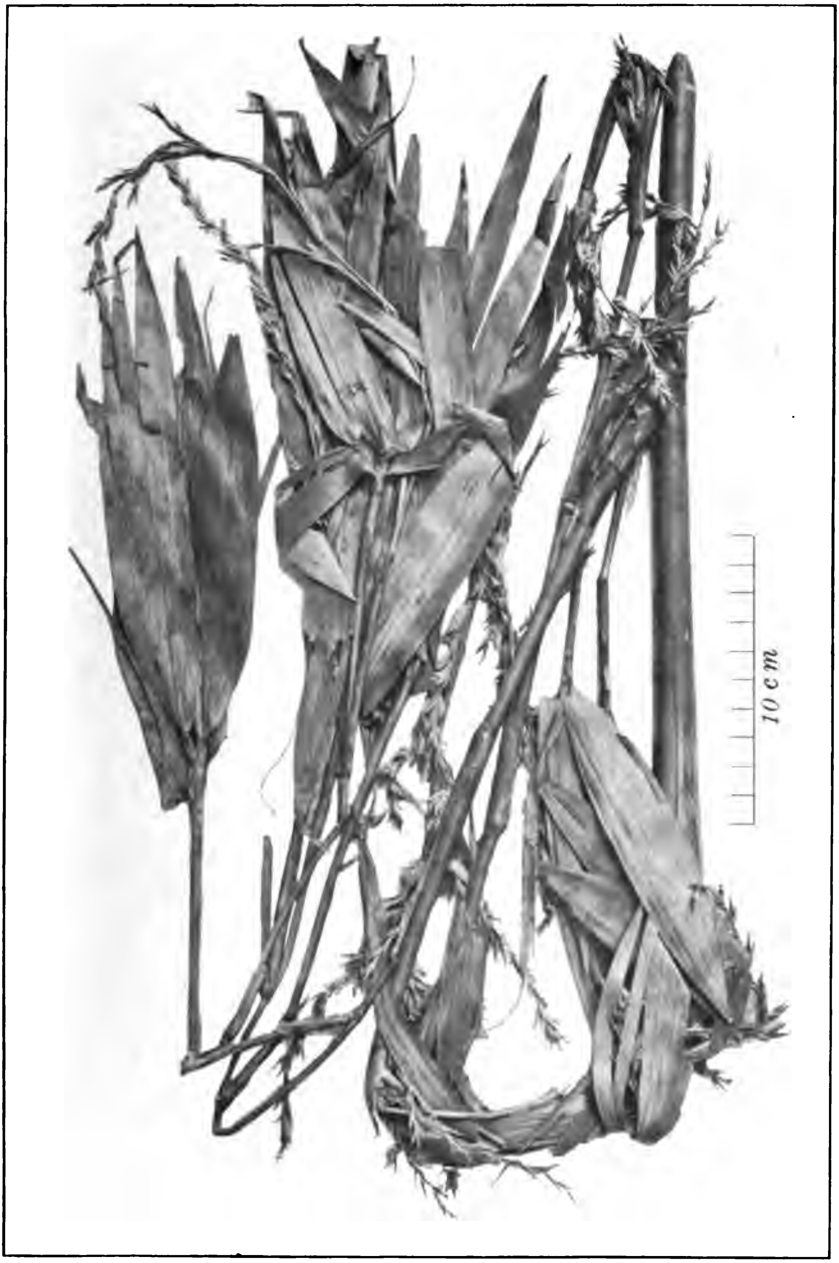

PLATE XXX. SCHIZOSTACHYUM LUZONICUM GAMBLE. COTYPE SPECIMEN.

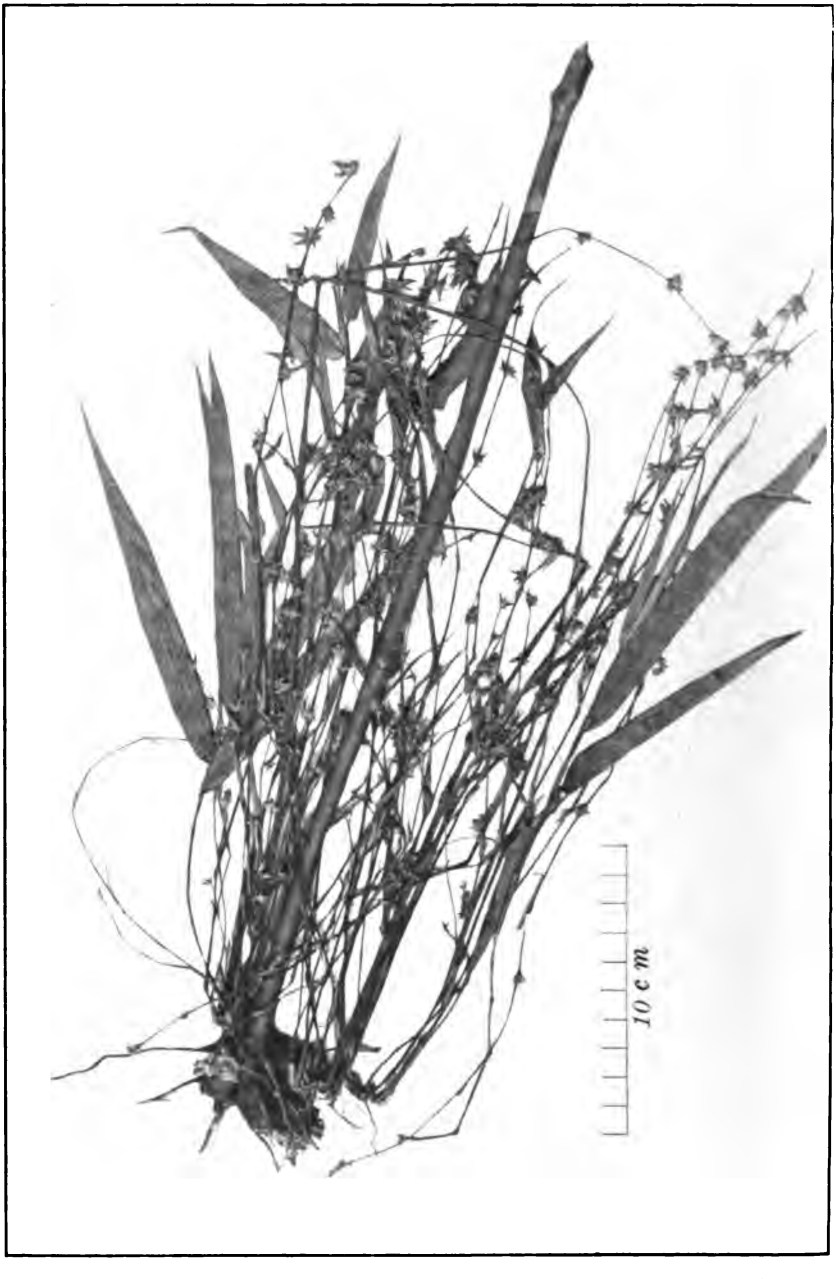

PLATE XXXI. SCHIZOSTACHYUM PALAWANENSE GAMBLE. TYPE SPECIMEN.

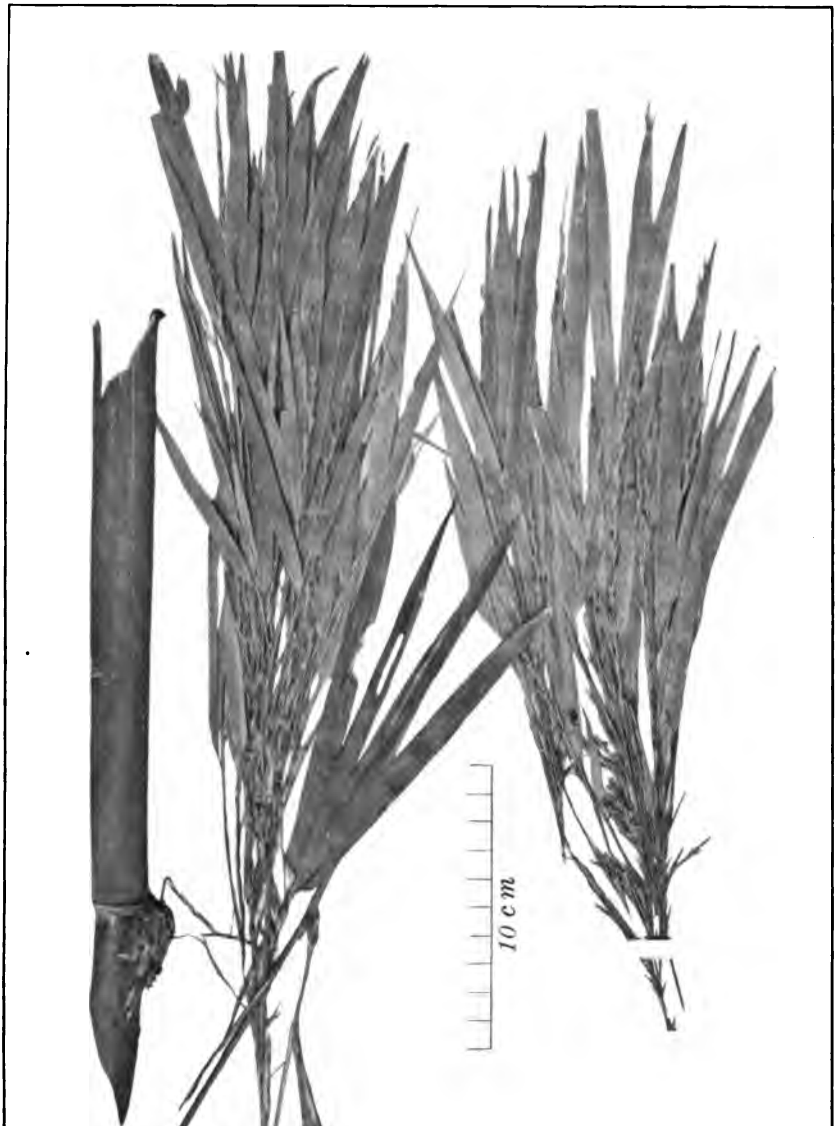

PLATE XXXII. SCHIZOSTACHYUM TEXTORIUM (BLANCO) MERR.

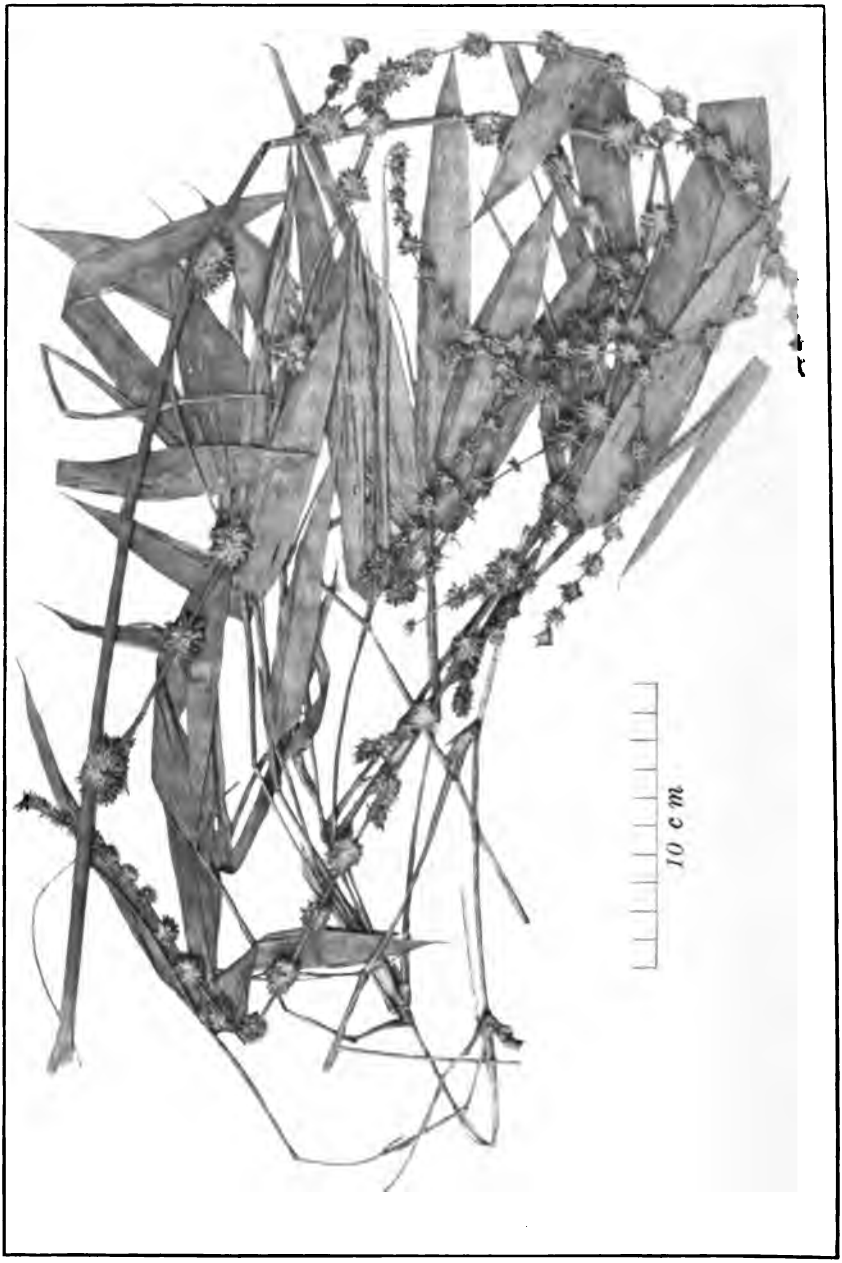

PLATE XXXIII. SCHIZOSTACHYUM TOPPINGII GAMBLE. COTYPE SPECIMEN.

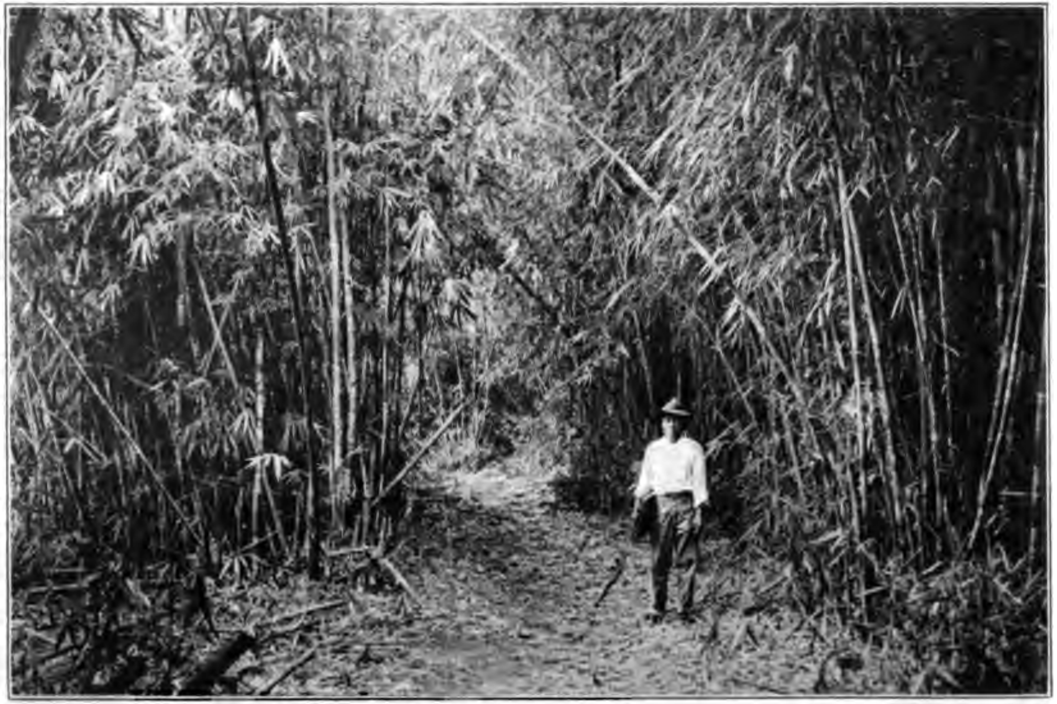

PLATE I. VIEW ALONG A TRAIL IN FOREST OF SCHIZOSTACHYUM LUMAMPAO.

Philippine Forest Products As Sources of Paper Pulp

BY

William H. Brown Ph. D.
Chief, Division of Investigation, Bureau of Forestry; Plant Physiologist, Bureau of Science; and Associate Professor of Botany, College of Liberal Arts, University of the Philippines

AND

Arthur F. Fischer C. E., M. F.
Director of Forestry; and Dean and Professor of Forestry, School of Forestry, University of the Philippines

Department of Agriculture and Natural Resources
Bureau of Forestry

Bulletin No. 16

Arthur F. Fischer, Director of Forestry

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160981

PHILIPPINE FOREST PRODUCTS AS SOURCES OF PAPER PULP

By William H. Brown and Arthur F. Fischer

INTRODUCTION

The increasing difficulty of obtaining wood pulp for paper has led to the examination of a great variety of substances to be used as substitutes. The possibilities for paper pulp in the Philippines have been investigated by Richmond and reported on in a series of articles in the Philippine Journal of Science.*

Since Richmond's articles appeared very little information has been obtained concerning paper, except in regard to supply and yield of materials. The Philippines offer a particularly favorable site for the establishment of a paper industry, as raw material of good quality and at cheap prices is available. There is moreover a very considerable local market in addition to that which can be obtained by export. The Philippine Legislature has passed a law guaranteeing for a paper plant an interest of four per cent per annum for three or six years. The local demand is considerable, as can be seen from the fact that during the year 1917 paper and paper products to the value of 3,778,373 pesos were imported into the islands. In Manila alone there are eleven daily and eight weekly papers, besides numerous monthlies and quarterlies. Richmond has shown that there is not only a considerable amount of material for paper pulp to be derived from forest products, but that besides there are other very considerable sources. In the Philippines, clothes are made largely from cotton which is not mixed with wool, and by far the largest part of this cotton is white, so that cotton rags offer considerable possibilities for the manufacture of paper. Among the agricultural products may be mentioned abacá (Manila hemp) waste, banana fiber, sisal, and maguey waste. In the process of stripping commercial fiber from abacá as much or more waste fiber is left in the stalk than is extracted. Richmond has found that this material makes an excellent paper. The abundance of this waste is shown by the fact that 171,148 metric tons of abacá were exported from the Philippine Islands during the past year. The growing of sisal and maguey is increasing rapidly and these sources should soon offer considerable material for paper. Richmond has also shown that banana fiber makes an excellent paper. He calculated that 33,913 hectares in the Philippines were used for raising bananas. When a banana stalk once bears fruit, the stalk is then cut down and usually allowed to decay so that this possible source of paper pulp is now entirely wasted, except when used for food for stock. Besides the cultivated bananas there are large tracts of wild bananas in the Philippines.

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* Richmond, G. F., Philippine fibers and fibrous substances: Their suitability for paper-making, *Philippine Journal of Science,* Vol. I, p. 433; Part II, Vol. I, p. 1075; Part III, Section A, Vol. II, p. 81.

——Philippine fibers and fibrous substances: Their suitability for paper-making, *Philippine Journal of Science,* Section A, Vol. V (1910), p. 233.

Among the forest products which offer immediate prospects for paper pulp are three plants: one a bamboo (*Schizostachyum lumampao*) and two grasses, cogon (*Imperata exaltata*) and talahib (*Saccharum spontaneum*). The other sources will be mentioned later.

BAMBOO FOR PAPER

Perhaps the most promising source for paper material is offered by the moderate sized thin-walled bamboo, *Schizostachyum lumampao.* For a description of this plant and its production, see Bulletin 15, on bamboos.

As is well-known bamboo has long been used for making paper in China. In fact, it is the chief material in use for this purpose in that country. Various species of bamboo in other countries have also been made into good paper as will be seen by referring to Richmond's articles.

The following excerpt communicated by Consul Henry D. Baker, of Trinidad, British West Indies, in the United States Commerce Reports No. 57 of March 9, 1918, shows how favorably bamboo is considered as a paper material.

> The publishing house of Thomas Nelson & Sons, of Edinburgh, Scotland, has an important project under way for manufacturing paper from bamboo in Trinidad. About 1,000 acres of land near St. Joseph (7 miles from the capital at Port of Spain) have been planted in bamboo, and a concession has been obtained giving the firm the right to cut bamboo from the Government forests.
>
> It appears that Thomas Nelson & Sons, foreseeing a paper famine throughout the world within the next few years, have been giving very serious consideration to the problem of providing adequate paper reserves for themselves for the future; and although realizing that paper can be manufactured from any vegetable material containing cellulose, nevertheless, it seemed to them that bamboo was most suitable for the purpose. They selected Trinidad for their bamboo-paper project, as the bamboo grows here very quickly, having sufficient development within three or four years for making paper. Moreover, Trinidad is within a reasonably short distance by sea from Edinburgh, being, of course, much nearer to their headquarters than are the bamboo forests of Asia.

Raitt[*] in discussing the paper sources in India describes bamboo as an excellent paper material.

As has been shown in Bulletin 15, dealing with bamboo, *Schizostachyum lumampao* covers extensive, accessible areas in the Philippines. A combination of the data given in Bulletin 15 for this bamboo and Richmond's figures for yield of pulp will enable us to form an estimate of the amount of pulp that can be secured from a given area. In the discussion of this species, it was shown that an average hectare of *Schizostachyum lumampao* contains approximately 9,000 canes. Richmond found that an average green stem weighed 7.2 kilograms; an air-dried stem, 4 kilograms; and an air-dried one without the nodes, 3.75 kilograms. Using this last figure it will be seen that there would be 33.75 metric tons of dried material per hectare. Richmond calculated that 2 metric tons of dried material would give about 1 short ton of pulp. A hectare should therefore produce about 17 tons of pulp.

No exact figures concerning the cost of collection of *Schizostachyum lumampao* can be given. It is sold in Orani, Bataan Province, at from 8 to 12 pesos per thousand stems. Richmond calculated that a thousand canes could be cut and transported a distance of 1 to 2 kilometers at a cost of between 6.33 to 8.16 pesos. All of these figures apply, of course, only to the crude, primitive method at present employed in collecting this material. However, even at a price of 10 pesos per thousand stems, the material for a ton of pulp would cost only 2.50 pesos.

Concerning the preparation of paper pulp by the soda process from *Schizostachyum lumampao,* we may quote the following from Richmond:

> It was found as the result of repeated trials with caustic soda liquors under varying conditions of strength, pressure and duration of cooking, that bamboo chips prepared as outlined above invariably yielded 43 to 45 per cent of air-dry, unbleached fiber under the following conditions:
>
> (*a*) Upright cylindrical stationary digestors.
>
> (*b*) Direct live-steam heat.
>
> (*c*) Fifteen to 20 per cent of 76 per cent caustic soda calculated on the air-dry weight of the raw material.
>
> (*d*) A duration of cooking of four to six hours.
>
> (*e*) A maximum temperature of 160° C. (320° F.) corresponding to a steam pressure of 45 kilos (90 pounds).
>
> Fiber thus prepared bleached to a splendid white with 12 to 15 per cent of bleaching powder. The fiber was strong, of good felting capacity, and it made a more bulky sheet than wood pulp. Bamboo fibers average 2.5 to 3 millimeters in length, so that they are somewhat longer and materially narrower than spruce fibers.

---

[*] Raitt, Wm., New fibers for paper, *The Indian Forester,* Vol. 36 (1910), p. 34.

That bamboo is readily resolved by the soda process of treatment to a fiber which is easily blended has been proved beyond doubt, and further experiment in this direction is scarcely necessary. The fiber possesses the requisite length, strength, and felting capacity to meet the paper maker's demands, and the quantity of resistant cellulose per unit weight of the raw material is sufficient to warrant its extraction.

The following quotations also from Richmond give information concerning the sulphite process on *Schizostachyum lumampao:*

Bamboo chips prepared as described above, in lengths varying from 1.270 to 2.540 centimeters, but uncrushed, were well screened from dust and dirt and packed into a stationary, upright, lead-lined digester and heated with direct fire in the presence of sulphite liquors of different concentration and under varying conditions of temperature and time. Thirty-seven separate digestions were made, but in no instance was I able to produce from bamboo a pulp easy to bleach with bleaching powder, the universal bleaching agent employed in the industry at the present time.

The process yields fully 50 per cent of unbleached pulp and with a much lower sulphur consumption than is required in commercial practice for wood. Well prepared, but uncrushed chips pulped readily with liquors of ordinary strength in six to eight hours, but the unbleached fiber was not as light in color as sulphite spruce and could only be used in the unbleached condition for wrappings, tags, etc., where strength, rather than color, is the important consideration. It is needless to say that I varied all the conditions of the treatments in every conceivable manner with the main point in view of producing a pulp which would bleach readily, and with a reasonable consumption of bleaching agent, but without success. If bamboo pulp were most suited for use in an unbleached state, then the sulphite process should be adopted by all means, but the material is not sufficiently light in color to be mixed with mechanical wood pulp in preparing news print paper, besides it is too good a fiber for the latter or for wrappings, for which it is entirely suited so far as color is concerned. In my opinion, bamboo fiber is eminently fitted for paper for books and for certain grades of writing and lithographic papers, either alone or when blended with rag or sulphite wood pulp.

A few data selected from the more successful sulphite experiments are given: [Table I.]

TABLE I.

Experiment No.	Composition of the liquor.				Conditions of time and temperature.			Yield of unbleached pulp.	Bleach consumed.	Sulphur consumed per ton of pulp.	Color.
	Lime.	Total acid.	Combined acid.	Free acid.	Time to reach maximum.	Total time.	Maximum temperature.				
	Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Hrs.*	*Hrs.*	°C.	*Per ct.*	*Per ct.*	*Metric.*	
1	1.17	3.87	1.34	2.52	3½	7	145	52.4	30	149.6	Poor white.
2	1.28	4.53	1.47	3.04	3	7	150	50.2	27.6	240.0	Do.
3	1.09	3.39	1.25	2.14	4	9	145	50	24.12	240.0	Do.
4	1.12	3.71	1.28	2.43	3	8	145	51	28.5	223.5	Do.

> It will be noted that from 24 to 30 per cent of bleaching powder was required to produce at best a poor white, that is, 12 to 15 kilos of bleaching powder of the standard strength (35 per cent available chlorine) are required for 50 kilos of unbleached pulp. This consumption is excessive, and it forms the greatest objection to placing bamboo pulp prepared in this way on the market. . .
>
> Aside from the poor bleaching properties of bamboo sulphite fiber prepared under the above conditions, there are other factors, both local and general, which tend to preclude the use of the sulphite process of treating bamboo at the present time.
>
> 1. Bamboo fibers appears better suited for book printing and lithographic papers than for wrapping or news printing paper. This being the case, bulk, softness, and opacity, which are the chief features of soda fiber, are what is desired. . .
>
> 2. It is undoubtedly true that the sulphite process costs less than the other for chemicals. Sulphur, at present quotations, can be converted into sulphite liquor and thrown away after use at less expense than the cost of soda actually consumed plus the cost of its recovery. However, the local supplies of limestone are better adapted for making soda than sulphite liquor. . .
>
> The other chemicals, sulphur on the one hand and soda on the other, used in the two processes, are not produced locally, hence would have to be imported from the most favorable foreign source.

Richmond also investigated *Bambusa spinosa* as a source for paper pulp, and found that this species gave a smaller yield of cellulose than *Schizostachyum lumampao* and required an excessive amount of bleach (20 to 25 per cent) to produce at best a poor white.

GRASS FOR PAPER

Indications are that approximately the whole Archipelago was originally covered with forest. However, a shifting system of cultivation has reduced large parts of forested areas to waste grassland until at the present time about 40 per cent of the total land surface of the Archipelago is covered by grass, particularly the two species, cogon (*Imperata exaltata*) and talahib (*Saccharum spontaneum*). These grasslands originated in the following manner. When a forest is clear cut and cultivated by primitive methods, grass and weeds invade the area. In order to remove these, it is a common practice to cut all plants and burn. This effectually kills the tree seedlings and shrubs, but does not harm the grass, which grows from strong underground stems. The result of several such fires is that the land is left in the possession of the grass, which is hard to eradicate by primitive methods of cultivation. Grass areas once established are usually burned over every dry season and so remain almost indefinitely in grass. If these grasses were cut for paper-pulp manufacture the cutting would have much the same effect as fire in keeping out other vegetation. Burning or cutting these grasses seems to have no injurious effect on the stand but rather causes an increase in the rate of growth. From the foregoing, it will be seen that abundant grass areas can be found for the production of tremendous quantities of raw material.

Richmond has investigated both cogon and talahib as sources of paper pulp and concluded that both species would make an excellent paper.

Cogon is a rank-growing, sod-forming grass about 1.5 meters in height. The study of cogon was carried on in connection with esparto grass, which has long been in use for the manufacture of paper. Comparative analyses of these two species are given in Table II. Table III indicates the yield of paper cellulose to be expected under factory conditions, and the treatment and amount of soda necesary to produce a well-boiled paper. All four of the pulps produced by the experiments in Table III were light gray, clear, and appear to be well reduced. An investigation of cogon also showed that no preliminary treatment was necessary, but that after being dried and hand picked or machine cleaned, it was ready for immediate digestion.

TABLE II.—*Analysis of cogon and esparto grass.*[a]

Ash, alkaline hydrolysis, and cellulose calculated on dry material.

	Cogon grass.	Esparto grass (Spanish).
	Per cent.	*Per cent.*
Moisture	9.82	8.68
Ash	4.53	3.71
Hydrolysis (a)	25.77	19.75
Hydrolysis (b)	40.00	37.16
Cellulose	50.11	55.16

Chemical composition of cogon and esparto grass.

	Cogon.	Esparto.
	Per cent.	*Per cent.*
Cellulose	46.68	48.25
Fat and wax	1.16	2.07
Aqueous extract	10.80	10.19
Pectous substances	26	26.39
Water	11.33	9.38
Ash	4.03	3.72

[a] Figures from Richmond, G. F., *Philippine Journal of Science*, Vol. 1 (1906), p. 458.

TABLE III.—*Experiments on cogon grass, showing amount of caustic soda used and yield of pulp.*[a]

Percentage of—	Experiment 1.	Experiment 2.	Experiment 3.	Experiment 4.
Soda liquor	2	2.4	2.5	3
Caustic calculated on weight of material	10	12	12	15
Yield of pulp	47.34	45.5	45.42	44.25

[a] Figures from Richmond, G. F., *Philippine Journal of Science*, Vol. 1 (1906) p. 458.

Talahib is a taller grass than cogon and frequently reaches a height of more than 3 meters. It is a bunch grass and usually occurs in moister situations than cogon and forms denser stands.

TABLE IV.—*Analysis of talahib grass.*[a]

Moisture	10.23
Ash	5.46
Hydrolysis (a)	27.44
Hydrolysis (b)	40.53
Cellulose	53.90

[a] Figures from Richmond, G. F., *Philippine Journal of Science*, Vol. 1 (1906), p. 458.

In Table IV, from Richmond's publication, is shown the percentage of cellulose obtained from this species. The pulp bleached to a good white with only 2.3 per cent loss in weight by the use of 5.7 per cent of bleaching powder calculated on the original weight of the material digested.

Raitt * says that *Saccharum sara* of India yields an excellent, easily bleached paper similar to that of wheat straw.

MISCELLANEOUS PRODUCTS

Several species of palms, including rattans, nipa, buri, and coconut, are widely distributed throughout the Archipelago and contribute to the local demands of the people for food and shelter. A discussion of their distribution will be given in a bulletin on palms. The fibrous products of some of these palms might offer a considerable source for paper. Richmond * made unbleached paper from buri palm rope and found it to be strong and fairly free from shive.

The bark of *Wikstroemia ovata, W. Indica, W. meyeriana* and other species of the same genus is collected in considerable quantities and exported to Japan where it is said to be used for the manufacture of bank notes and other strong papers. This plant is a small bush which is scattered in thickets throughout the Philippines. Most of the bark collected comes from the vicinity of Mount Mayon and from Mindanao.

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* Raitt, Wm., New fibers for paper. *The Indian Forester*, Vol. 36 (1910), p. 34.

* Richmond, G. F., *Philippine Journal of Science*, Vol. I, p. 1084.

In the Philippine Islands there are large numbers of plants with strong bast fibers. Some of these might be useful for high-grade paper or for strengthening paper made from weaker material. These barks will be discussed in a later bulletin.

In Table V, are given the dimensions of the ultimate fibers of some of the plants previously discussed.

TABLE V.—*Dimensions of the ultimate fibers of some Philippine fiber plants.*

[Taken by Dr. E. B. Copeland. All measurements in millimeters.]

Name.	Length.			Diameter.					
				Total.			Lumen.		
	Maximum.	Average.	Minimum.	Maximum.	Average.	Minimum.	Maximum.	Average.	Minimum.
Abacá (*Musa textilis*)	6.00	3.98	2.45	0.021	0.017	....	0.009	0.0066	....
Plantain (*Musa sapientum var. paradisiaca*)	7.30	5.49	4.15	.026	.020	0.018	.016	.0106	0.007
Maguey (*Agave cantula*)	4.93	2.88	1.00	.026	.018	.005	.013	.007	.004
Cogon grass (*Imperata exaltata*)	1.82	0.99	0.46	.021	.011	.005	.013	.0044	.001
Talahib grass (*Saccharum spontaneum*)	2.82	1.59	0.80	.020	.015	.012	.010	.0043	.1115
Bamboo (*Bambusa blumeana*)	....	1.81	....	....	.0075	....	....	....	....
Dwarf bamboo (*Bambusa lumampao*)	4.10	2.57	1.20	.028	.0156	.005	.025	.018	.001
Rice straw (*Oryza sativa*)	....	0.88	....	....	.0025	....	....	....	....
Buri palm (*Corypha elata*)	2.80	2.11	1.10	.015	.013	.010	.007	.0084	.002

As far as we now know, the Philippine forests in general do not offer particular favorable conditions for the gathering of pulp material. This is due to the fact that the composition of the forests is very complex. On one-quarter of a hectare of virgin forest on Mount Maquiling there were 92 different tree species. In an over-cut area of the same size there were 129 different species. However, conditions are not always as unfavorable as these figures would indicate, as frequently the bulk of the timber is comprised in only a few species, these species being usually of the same family. In some forests the composition is probably uniform enough and the volume of timber sufficient for pulpwood to be collected economically. However, the wood in these forests commands such a price that it is doubtful if it would be profitable to use the wood for paper pulp. The most feasible means of producing pulp from wood would probably be in connection with large sawmill units in using the waste for pulp. In large forests there is always a considerable proportion of defective timber and besides in the operations of cutting there is always a large amount of waste produced. Trees which do not produce commercial lumber could, moreover, be cut and taken in at the same time as other logs. Richmond * has investigated several species of trees as a source of paper pulp. His figures on lauan, palosapis, and kupang are interesting, as these trees occur in large numbers. The first two form dense stands and produce a large part of the lumber cut in the Philippines. Palosapis and lauan are very similar in structure to other Philippine woods which occur in large quantities. The length of the ultimate fibers of these woods is given in Table VI. The figures in this table are taken from a longer table by Dr. F. W. Foxworthy. The approximate analyses of these woods is given in Table VII, taken from Richmond. In Table VIII, are given data on experiments with the soda process on lauan, palosapis, and kupang; and in Table IX, are data on the sulphite process.

TABLE VI.—*Dimensions of the ultimate fibers of some Philippine woods.*

[Figures from table by Dr. F. W. FOXWORTHY.]

Name.	Length.			Diameter.					
				Total.			Lumen.		
	Maximum.	Average.	Minimum.	Maximum.	Average.	Minimum.	Maximum.	Average.	Minimum.
	mm.	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*
Lauan (*Pentacme contorta*)	2.28	1.94	1.13	0.026	0.022	0.017	0.017	0.014	0.009
Palosapis (*Anisoptera thurifera*)	2.62	1.92	1.16	0.030	0.023	0.019	0.0092	0.0058	0.0031
Kupang (*Parkia javanica*)	1.80	1.15	0.86	0.038	0.029	0.021	0.026	0.020	0.014

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* G. F. Richmond, *Philippine Journal of Science*, Section A, Vol. II, 1907, p. 81.

TABLE VII.—*Proximate analyses of Philippine woods.*

[Data from RICHMOND.]

Kind of wood.	Water.	Aqueous extract.	Alcohol ether extract.	Cellulose.	Incrusting matter.	Ash.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Lauan	11.23	3.85	2.72	61.71	19.57	0.89
Palosapis	11.50	4.50	1.20	55.73	28.24	0.83
Kupang	13.33	3.45	1.17	60.56	19.41	2.03
Dita	10.41	4.19	0.60	49.91	33.87	0.99

TABLE VIII.—*Experiments with soda process on Philippine woods.*

[Data from RICHMOND.]

Experiment No.	Caustic soda solution.	Caustic soda calculated on weight of material.	Duration of digestion.	Pressures carried.	Yield of pulp. Unbleached.	Yield of pulp. Bleached.	Bleaching powder consumed.	Loss of weight in bleaching.
Lauan:	*P. ct.*	*P. ct.*	*Hrs.*	*Atmospheres.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
1	10	25	9	6	40.9			
2	7.5	22.5	11	6	42.37	40	17.1	5.69
3	5	20	5	5 (7½)	45.2	40.3	18.8	10.8
4	3.75	15	10	6-8	45.28			
5	3.5	12.5	10	6-8	48.6			
Kupang:								
1	7.5	25	8	7	41.91			
2	6	20	10	6	43.71	40.3	16.5	7.8
3	4.7	20	8	7	44.97	40.2	18.4	10.6
4	3.75	15	8	6-8	48.4			
5	3.5	12.5	8	6-8	50.4			
Palosapis:								
1	10	22	5-6	5	38.5			
2[a]	6.25	20	10	6-7	41.85	40.7	9.9	2.74
3[b]	5	20	5	6-7	42.5	41	12	3.53
4	4	17.5	5	6-7	44	41.19	15.4	2.81

[a] Good white color.

[b] Yellowish color.

TABLE IX.—*Experiments with sulphite process on Philippine woods.*

[Data from RICHMOND.]

Kind of wood and experiment No.	Composition of liquor.			Duration of digestion.		Maximum temperature carried.	Yield of pulp.		Bleaching powder consumed.	Screenings.
	Total SO2.	Combined SO2.	Available SO2.	Time to reach maximum temperature.	Total time.		Unbleached.	Bleached.		
Lauan:	*P. ct.*	*P. ct.*	*P. ct.*	*Hrs.*	*Hrs.*	°*C.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
1	3.6	1.6	2.0	4	12	160	42.2			1.8
2	3.5	1.2	2.3	5½	11	150	44.4	43.3	13.4	
3	3.75	1.78	1.97	4½	11	155	46			1.75
Palosapis:										
1	3.52	1.63	1.89	4½	9	154	47.27			
2	3.45	1.35	2.10	5½	11	150	44.75	42.35	14	
3	3.75	1.78	1.97	4½	11	155	46			1.4
Kupang:										
1	3.6	1.2	2.4	4	10	145-155	40.76	43.2	8.51	
2	3			4	16	160	49.4			3.0
3	3.75	1.78	1.97	4½	11	155	47			0.0

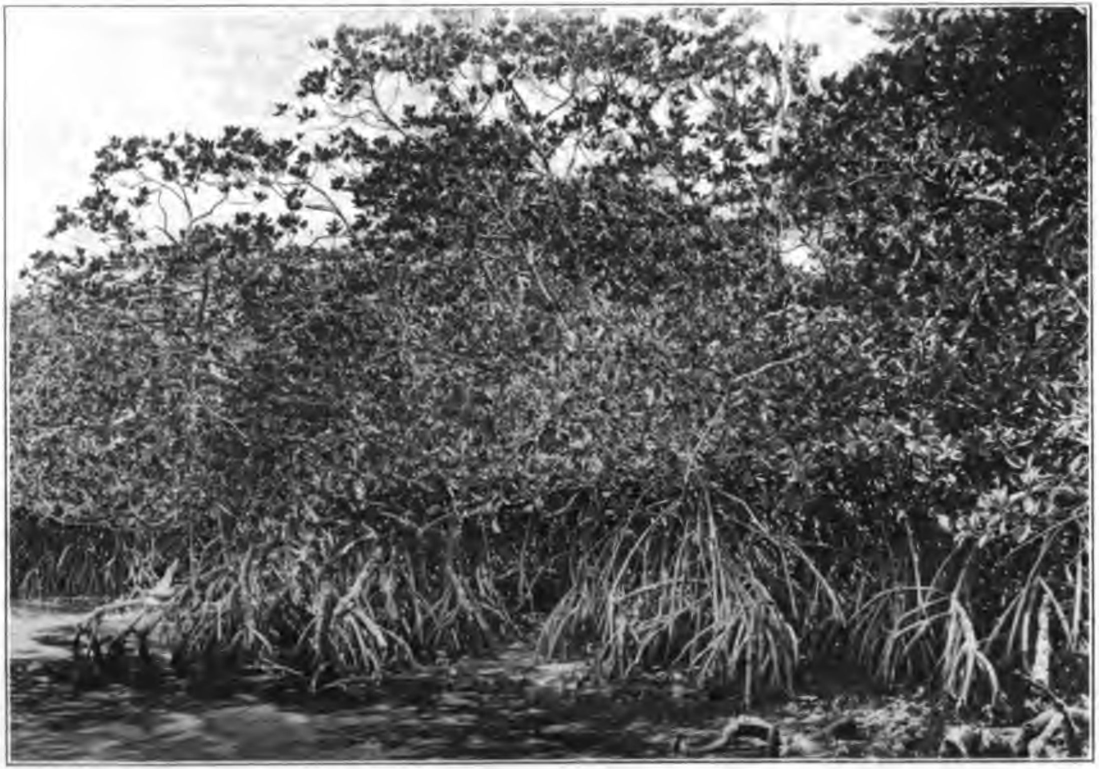

PLATE I. RHIZOPHORA CANDELARIA INVADING A MUD FLAT.

Philippine Mangrove Swamps

By William H. Brown, Ph. D.
Chief, Division of Investigation, Bureau of Forestry; Plant Physiologist, Bureau of Science; and Associate Professor of Botany, University of the Philippines,
and

Arthur F. Fischer, C. E., M. F.
Director of Forestry; Dean and Professor of Forestry, School of Forestry, University of the Philippines

Department of Agriculture and Natural Resources
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PREFACE

This bulletin is the third in a series dealing with minor forest products. Although the mangrove swamps produce valuable woods, they have been included in this series on account of the fact that they are utilized more for their minor forest products than for timber. The principal minor forest products derived from them are firewoods, tanbarks, dye barks, and the various products of the nipa palm, including thatching material and alcohol. The nipa palm is also a promising commercial source of sugar. Besides the products just mentioned, there are a number of other minor ones which will be discussed in the text.

The mangrove swamps constitute a very valuable asset to the Philippine Islands and, if properly managed, will prove to be a permanent source of considerable income both to the people and the Government. This bulletin is presented in the hope that it will aid in giving a better understanding of the swamps, their commercial possibilities, and the methods of their utilization.

In preparing this bulletin we have made use of records in the Bureau of Forestry, and have taken considerable information from a bulletin on Mangrove and Nipah Swamps of British North Borneo, by F. W. Foxworthy and D. M. Matthews. The descriptions of the various woods are taken from Bulletin 14, Commercial Woods of the Philippines, by E. E. Schneider. The writers are greatly indebted to Mr. E. D. Merrill, of the Bureau of Science, for very valuable help in preparing this bulletin and to Dr. F. W. Foxworthy for criticising the manuscript. The pictures of the flowering and fruiting specimens were taken for the writers through the courtesy of the Bureau of Science by the official government photographer, Mr. E. Cortes. The two drawings were made by Mr. J. K. Santos, assistant in botany, University of the Philippines. Mr. R. C. McGregor, special editor of the Philippine Journal of Science, has been of great assistance in helping in the preparation of this manuscript for the printer. For the above assistance we desire here to express our grateful appreciation.

WILLIAM H. BROWN.
ARTHUR F. FISCHER.

PHILIPPINE MANGROVE SWAMPS

By WILLIAM H. BROWN AND ARTHUR F. FISCHER

INTRODUCTION

The mangrove swamps of the Philippine Islands apparently occupy between 400,000 and 500,000 hectares. No accurate survey of them has been made and the estimate of the area is based on reports from forest officers, Coast and Geodetic Survey maps, and forest maps. The area may exceed what is here given, but it is believed that it will not be less. The figure given includes also most of the areas of nipa swamps, as the classification has not, in most cases, been exact enough to show, in detail, how much of the swamp was in mangrove and how much in nipa.

The term mangrove swamp is applied to the type of forest occurring on tidal flats along sea coasts. They are found fringing the shores of the islands of the Philippine Archipelago and extending inland along the streams where the water is brackish (Plate II). The conditions most favorable for their development are found in quiet bays into which flow large rivers whose lower reaches have little fall.

The descending waters of the river are checked when they meet tidewater and deposit their sediment in the form of broad mud flats or deltas near the mouths of the rivers.

These flats are usually cut by a network of channels through which the advancing and receding waters of the sea move. At extreme low tide the flats are exposed and often even the larger channels are dry.

On these mud flats the trees and other plants which form the mangrove and nipa-swamp vegetation find conditions favorable to their development and, as the seeds of these species are distributed by water and can be transported for long distances without injury, the formation of flats and their seeding are practically simultaneous. The growth of all species is very rapid and the flats soon become dense forest, and remain so as long as the conditions which produced them are not disturbed (Plates III, IV). When the shore formation is favorable, new flats are formed beyond the old and the forest advances year

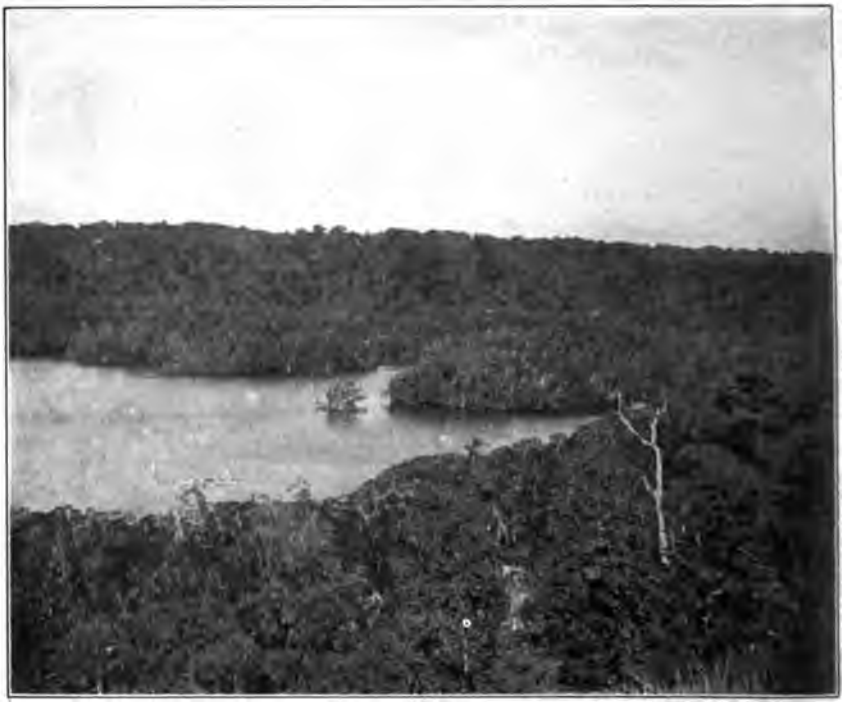

Fig. 1. Looking across a mangrove swamp at head of Tubugan Bay, Port Banga, Zamboanga.

Fig. 2. Swamps along coast, under water at high tide.

PLATE II.

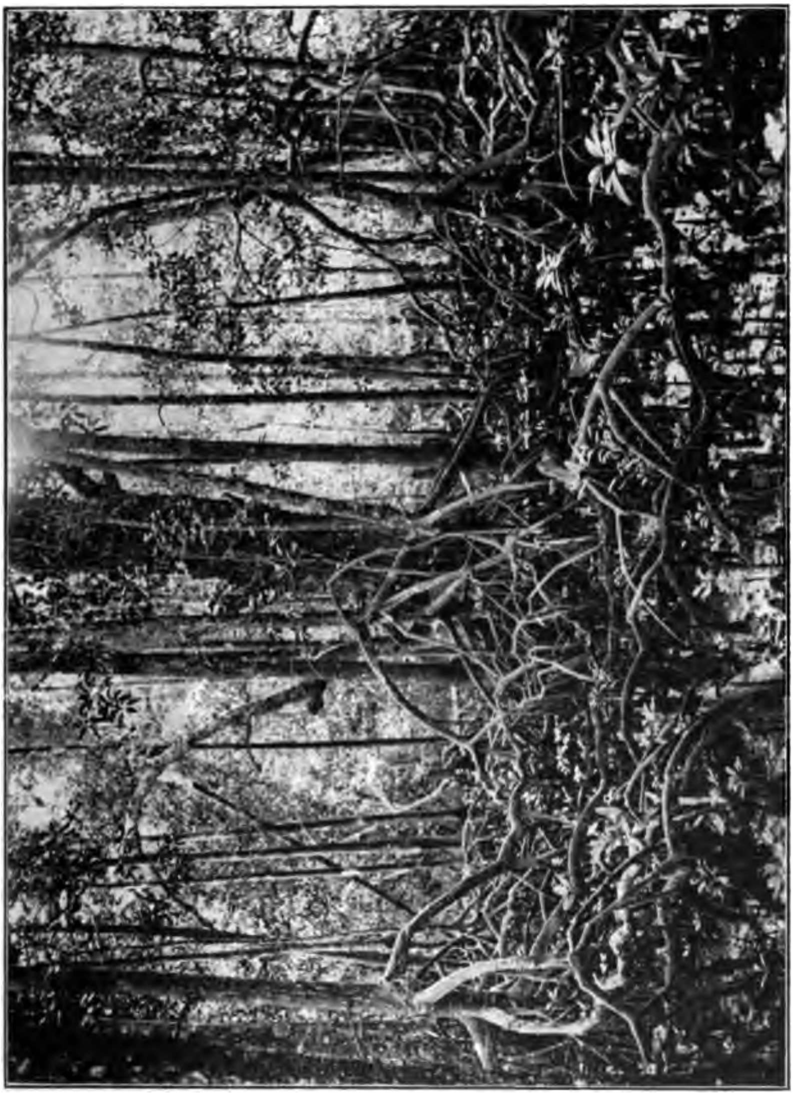

PLATE III. INTERIOR VIEW OF A MANGROVE SWAMP.

by year; its area diminishing or increasing as the lands drained or filled in by the action of the river are of greater or less extent than those newly formed. The draining and filling in of the lands on the upper limits of the swamp is very gradual, so that although the change from mangrove to dry forest is characteristic of these areas the process is extremely slow and less noticeable than the advance of the forest over newly formed flats on the sea edge of the swamp.

The mangrove forests may contain trees 1.35 meters in diameter; and when fully stocked, with mature timber, compare favorably with the commercial forests of the land. Areas with 650 cubic meters per hectare are found in the older swamps. These forests are not swamps and marshes, as we think of them in temperate regions, where trees grow in wet places that are periodically covered with standing water; but are literally forests of the sea with their roots in a stratum in which salt water is always present. For the greater part of the time the roots and even the lower part of the trunks of the trees are submerged in from 0.5 to 1 meter of salt water, while at high tide the lower limbs and foliage of the trees on the edges of the swamp are often submerged for a short time without injury (Plate II, fig. 1) ; conditions of life that would absolutely destroy ordinary forest trees.

Their character as forests of the sea is emphasized by the fact that when they form narrow strips, coral and sand beaches are often found back of the swamps on exposed coasts. The vegetation on these mud flats can be divided into two classes; mangrove swamps, in which large trees are present, and nipa swamps, which are characterized by a growth of the stemless palm, *Nipa fruticans*.

Mangrove-swamp forests, or "mangles," as they are called locally, are usually made up of thick stands of medium-sized and even-aged trees. Normally they are very free from undergrowth other than seedlings, and are characterized by the presence of roots showing on or above the surface of the ground (Plates I, III, IV, V, XVI, XXXVIII, and XLI). Depending upon the species in question, these may take the form of erect roots, knees, high prop roots, or mere swollen roots with side branches extending along the surface of the ground. The air roots have a spongy texture and absorb air which serves for the aëration of the root system. These peculiar roots are one of the most distinguishing characteristics of mangrove swamps. When the mud flats are not covered with water, the roots give a very peculiar appearance to the vegetation.

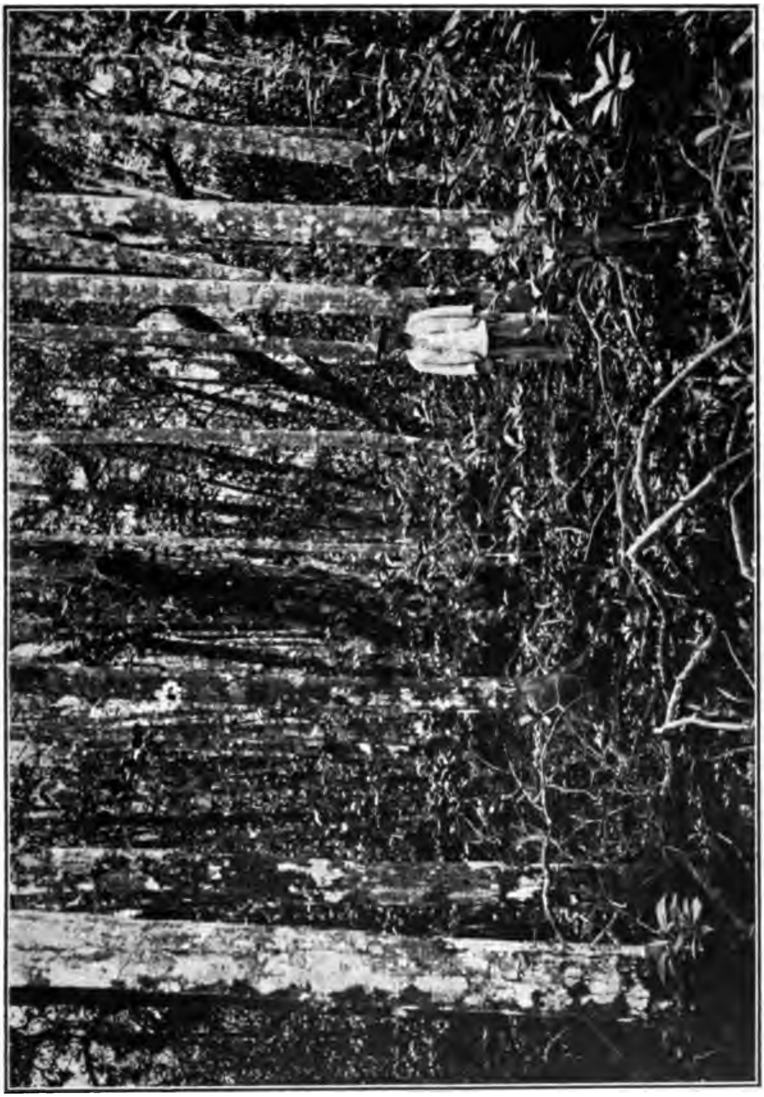

PLATE IV. INTERIOR VIEW OF A MANGROVE SWAMP.

The main tree species in a virgin swamp are few in number, and the principal ones are of the botanical family Rhizophoraceae. In this family there are found: *Rhizophora candelaria* and *R. mucronata; Ceriops tagal* and *C. roxburghiana;* and *Bruguiera conjugata, B. parviflora, B. cylindrica,* and *B. sexangula.* While these eight species are the ones most numerous in nearly all virgin swamps, scattered trees of pagatpat (*Sonneratia caseolaris*) often occur mixed with them or growing along exposed coral beaches. Api-api (*Avicennia* spp.) is sometimes found scattered in the more open places. Occasionally, this last-mentioned tree grows in pure stands along the inland edge of a mangrove swamp. Trees of the genus *Rhizophora* are frequently the first to seed upon and occupy the newly formed mud flats (Plate I). They are prop-rooted species, and normally grow on those portions of the swamp most deeply flooded by the tides. Such places are usually confined to the area along or close to water channels, although on low swamps *Rhizophora* forest extends farther inland. *Rhizophora mucronata* predominates in the fringe of trees bordering on waterways, while *Rhizophora candelaria* is by far commoner in the main forest within this outer fringe.

Trees of the genus *Bruguiera* occupy the portion of the swamp in which the ground is barely, if at all, flooded at high tide. Such places are usually toward the inland portions of the swamp and often, probably in the majority of cases, comprise a large percentage of its total area. As the ground level is raised by the natural filling in of the delta, it often happens that areas occupied by these *Bruguiera* forests become so high that they are seldom, if ever, flooded.

In open bays where the soil is mixed with considerable sand or coral limestone, there is a distinct frontal zone of *Sonneratia caseolaris* (Plate XVI), with some *Avicennia officinalis.* Wave-cut coral terraces often contain nearly pure stands of *Sonneratia caseolaris.*

Several other trees occur in these salt swamps, usually along their inner edges or in places where the stands are light. These include *Xylocarpus moluccensis, X. granatum, Lumnitzera littorea,* and *Aegiceras corniculatum. Heritiera littoralis* (dungonlate) is common on the higher ground which is still within the zone affected by salt water.

In swamp areas in which cutting has long been carried on the original and more valuable species are often largely replaced by *Avicennia* spp. (api-api). These species were considered to be of little value until the present fuel shortage.

PLATE V. ROOTS OF AVICENNIA OFFICINALIS EXPOSED BY WAVE ACTION.

Skirting the inland portions of the water channels, through which the tide ebbs and flows, is often found a strip of nipa palm (*Nipa fruticans*), usually narrow, although sometimes it occupies areas of considerable extent (Plates IX, XLV). In Pangil Bay, Mindanao, there is a single area of nipa covering 9,000 hectares. Nipa grows farther up the streams flowing through the mangrove forests than do the trees forming them, being found along streams where the effect of tide is barely noticeable. In some places the mangrove trees have been killed or cut out and nipa planted over wide areas of swamp. Such is the case north of Manila Bay, where much of the original tree growth has been entirely replaced by nipa.

Nipa has a large, branching, horizontal rhizome, or underground stem, which grows just below, or on the surface of, the soil and sends up short branches with a cluster of pinnate leaves, which rise 7 meters or more above the ground. Nipa frequently forms a dense mass of vegetation which is difficult to penetrate.

Undergrowth in a heavy virgin swamp is usually scanty, but in places where stands are light, in cut-over areas, and along the outer edges of the swamp, a fairly heavy undergrowth of vines, shrubs, ferns, and herbs is developed. Very noticeable in this are a swamp fern, *Acrostichum aureum*, and two spiny-leaved undershrubs, *Acanthus ilicifolius* and *A. ebracteatus.*

Among the commonest woody vines are *Derris trifoliata* Lour. (*D. uliginosa* Benth.), *Tristellateia australasiae* L. C. Rich., *Dalbergia candenatensis* Prain, *Caesalpinia nuga* Ait., *Caesalpinia crista* Linn., and *Finlaysonia obovata* Wall. Herbaceous vines are represented by the epiphytes *Hoya* and *Dischidia.*

Epiphytes are fairly numerous throughout the swamps. Perhaps the most conspicuous elements are the orchids, especially species of *Cymbidium* and *Dendrobium.* Epiphytic ferns are represented by *Drynaria quercifolia* J. Sm., *Polypodium sinuatum* Wall., and sometimes *Asplenium nidus* L. The most peculiar epiphytes are those containing cavities which are inhabited by ants. These are very abundant and are represented by *Myrmecodia, Hydnophytum,* and *Polypodium sinuatum* Wall. The bases of the stems of *Hydnophytum* and *Myrmecodia* are greatly enlarged and contain labyrinth cavities in which ants are found in large numbers (Plates VI, VII). The stems of *Polypodium sinuatum* are swollen and hollow, the cavities being inhabited by ants (Plate VII). *Dischidia saccata* Warb. is

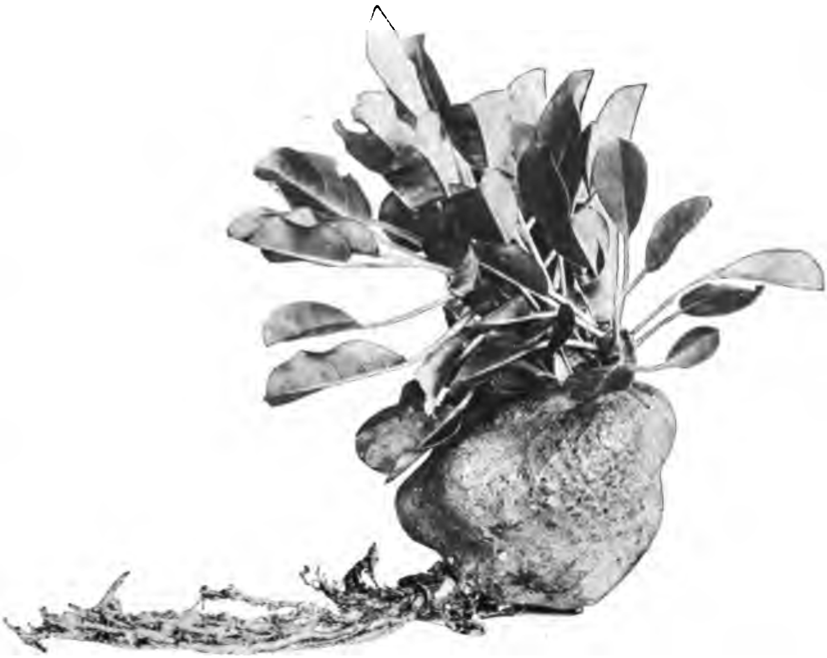

Fig. 1. Myrmecodia, a plant inhabited by ants.

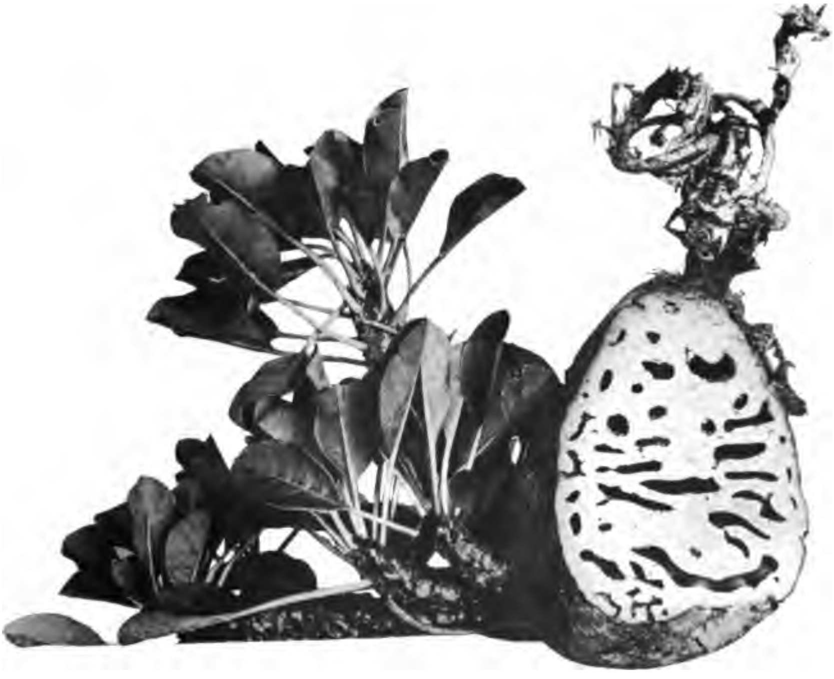

Fig. 2. A section through the base of a Myrmecodia.

PLATE VI.

found in some swamps. This plant has hollow leaves in which ants are found.

Reproduction is prolific in almost all places where seed trees are found, except along the higher inland portions of the swamp.

Back of the swamps are found numerous characteristic strand plants, and representatives of nearly all such plants in the region may be found in such situations. Among the common trees and shrubs back of the swamps are *Glochidion littorale* Blume, *Hibiscus tiliaceus* Linn., *Thespesia populnea* Corr., and *Barringtonia racemosa* Roxb. The sedge *Fimbristylis ferruginea* Vahl practically always occurs in such places, while along muddy banks *Cyperus malaccensis* Lam. is very common.

The chief commercial value of mangrove-swamp trees is for the production of firewood, charcoal, tannin, and dye barks. Some of the woods are also used for ship timbers, posts, ties, telegraph poles, piling, construction, finish, and furniture.

The nipa palm is very valuable as a source of thatching and alcohol and offers considerable possibilities for the production of sugar. For a discussion of the products of mangrove trees and the nipa palm, see the sections on these various subjects.

Mangrove trees serve a useful purpose in preserving water courses through the deltas at mouths of rivers. That they may be used to advantage to retain soil in engineering projects is shown by the following quotation:*

> The latest use of the mangrove in a practical way and one of which the writer has personal knowledge is the use of these trees as ballast retainers. This has been effectively demonstrated by the Florida East Coast Railway which has used the peculiar habit of the mangrove to advantage in their great feat of engineering, viz., the Oversea extension. At certain places these keys are connected by embankments supporting the road bed or where the bed is built high over a low flat key, the mangroves have been planted to prevent the erosive action of the sea on the ballast. This has been of greatest importance to the railroad and has protected the dykes just as the mangroves naturally sown have formed and protected young islands. Still more recently the writer has been of some small service to a large asphalt company concerning their engineering projects in Venezuela in which it is proposed to plant *Rhizophora mangle* along the dykes and jetties, etc., as a ballast retainer. This, it is hoped, will prove as efficient as the plantings of the Florida East Coast Railway have been in aiding the engineer in the tropics.

Mangrove swamps occur in similar situations in the tropics

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* Bowman, H. H. M., Ecology and Physiology of the Red Mangrove. Proceedings of the American Philosophical Society, Vol. LVI (1917) pp. 589–672.

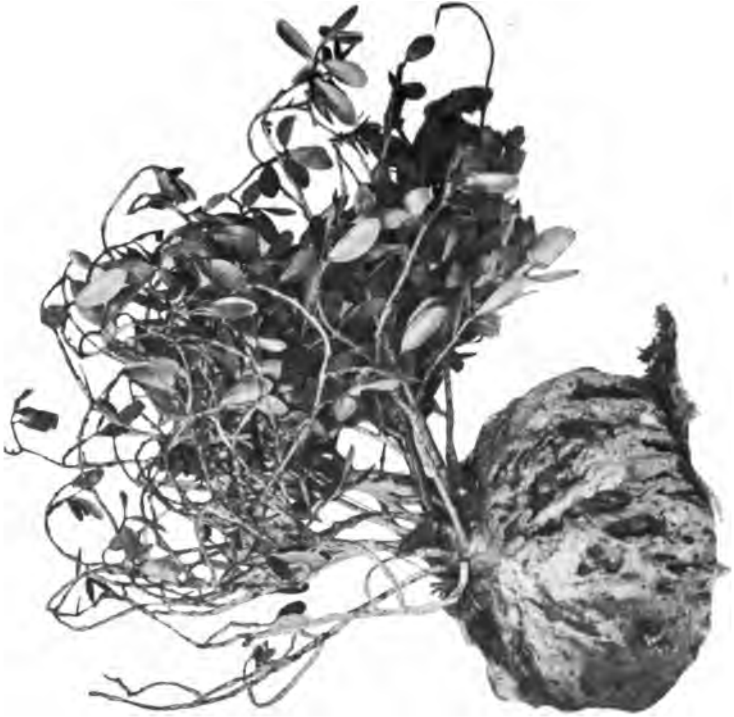

Fig. 1. Hydnophytum, a plant inhabited by ants.

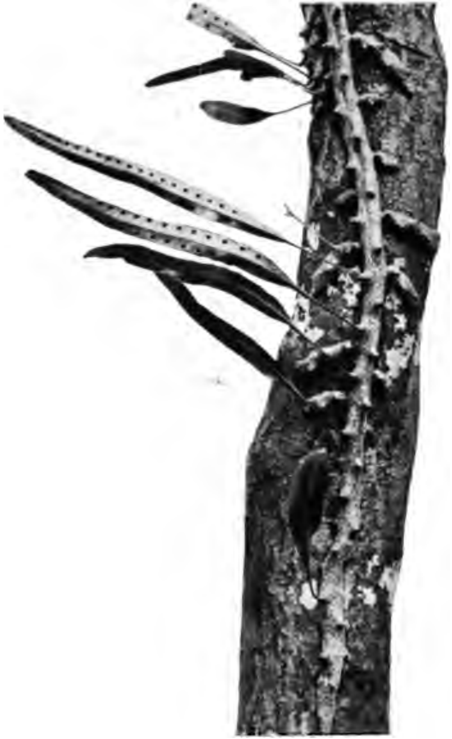

Fig. 2. Polypodium sinuatum, a plant inhabited by ants.

PLATE VII.

of both hemispheres. The Rhizophoraceae are the most prominent trees in all cases, but the species are different in America and in the Indo-Malayan regions. The composition is, however, very similar in East Africa and the Indo-Malayan regions. The tree species are few in number. In the Philippines twenty-five dicotyledonous trees have been reported from the mangrove swamps. The wide distribution of the species and the number of individuals of single species in the swamps make these forests unique among tropical forests.

LIST OF SPECIES IN PHILIPPINE MANGROVE SWAMPS WITH NATIVE AND FAMILY NAMES

Acrostichum aureum Linn. Lagolo. Polypodiaceae.
Nipa fruticans Wurmb. Nipa. Palmae.
Oncosperma filamentosa Blume. Anibong. Palmae.
Xylocarpus granatum (*obovatus*) Koen. Tabígi. Meliaceae.
Xylocarpus moluccensis (Lam.) M. Roem. Piagáu. Meliaceae.
Excoecaria agallocha Linn. Buta-buta. Euphorbiaceae.
Brownlowia lanceolata Benth. Maragomon. Tiliaceae.
Camptostemon (*Cumingia*) *philippinense* (Vidal) Becc. Gapas-gápas. Bombacaceae.
Heritiera littoralis Dryand. Dun͠gon-láte. Sterculiaceae.
Sonneratia alba (*acida*) Sm. Pedada. Sonneratiaceae.
Sonneratia caseolaris (*pagatpat*) (Linn.) Engl. Pagatpát. Sonneratiaceae.
Bruguiera conjugata (*gymnorrhiza*) (Linn.) Merr. Busáin. Rhizophoraceae.
Bruguiera cylindrica (*caryophylloides*) (Linn.) Blume. Potótan-laláki. Rhizophoraceae.
Bruguiera parviflora W. & A. Lan͠gárai. Rhizophoraceae.
Bruguiera sexangula (*eriopetala*) (Lour.) Poir. Potótan. Rhizophoraceae.
Ceriops roxburghiana Arn. Tan͠gál. Rhizophoraceae.
Ceriops tagal (Perr.) C. B. Rob. Tan͠gál. Rhizophoraceae.
Rhizophora candelaria (*conjugata*) DC. Bakáuan-laláki. Rhizophoraceae.
Rhizophora mucronata Lam. Bakáuan-babae. Rhizophoraceae.
Lumnitzera littorea Voigt. Tabáu. Combretaceae.
Lumnitzera racemosa Willd. Kulási. Combretaceae.
Osbornia octodonta F. Muell. Tawalis. Myrtaceae.
Aegiceras corniculatum (Linn.) Blanco. Saging-saging. Myrsinaceae.
Aegiceras floridum R. and S. Tinduktindukan. Myrsinaceae.
Cerbera manghas (*odollam*) Linn. Baraybáy. Apocynaceae.
Avicennia alba Blume. Api-api. Verbenaceae.
Avicennia officinalis Linn. Api-api. Verbenaceae.
Acanthus ebracteatus Vahl. Tigbao. Acanthaceae.
Acanthus ilicifolius Linn. Diliuariu. Acanthaceae.
Scyphiphora hydrophyllacea Gaertn. Nílad. Rubiaceae.
Pluchea indica Linn. Kalapini. Compositae.

*Scientific and local names of various mangrove species.**

Scientific names.	Local names.				
	Philippine Islands.	British North Borneo.	Sarawak.	Dutch Borneo.	Malay Peninsula and Singapore.
Rhizophora spp.	Bakauan {Bakauan lalaki Bakauan babae}	Bakau {Bankita Taggai}	Bako	Bako	Baku.
Ceriops spp.	Tangal	Tengah	Tengah	Hulit-tengah	Tengar.
Bruguiera conjugata *Bruguiera sexangula*	Pototan or Busain	Lenggadi or Pututan	Putut	Akat	Tumu.
Bruguiera parviflora	Langarai	B'eus	B'rus	B'eus	Lenggadai.
Avicennia spp.	Api-api	Api-api	Api-api	Api-api	Api-api.
Lumnitzera littorea	Tabau	Griting	Taruntum	Griting	Terentum.
Sonneratia caseolaris	Pagatpat	Perapat	Perapat	Perapat	Perepat.
Sonneratia alba	Pedada	Pedada	Pedada	Pedada	Pedada.
Heritiera littoralis	Dungon-late	Dungun	Dungon	Dungun	Dungun.
Xylocarpus granatum	Tabigi	Nirih			Nyireh.
Xylocarpus moluccensis	Piagao	Nirih	Niri	Niri	Nyireh batu.
Camptostemon philippinense	Gapas-gapas	Manggating			
Nipa fruticans	Nipa	Nipah	Nipah	Nipa or Hapong	Nipah.
Oncosperma filamentosa	Anibong	Nibong	Nibong	Njiboeng	Nibong.
Acanthus ilicifolius	Diliuariu			Djoeroedjoe	Jeruju.
Scyphiphora hydrophyllacea	Sagasa				Chengam.
Aegiceras corniculatum	Saging-saging			Troentoem	Kachang-kachang.
Excoecaria agallocha	Buta-buta	Buta-buta	Buta-buta	Taboeta	Buta-buta.
Acrostichum aureum	Lagolo	Play		Pakos larat	Paku laut, Piai.

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* From Foxworthy, F. W., and Matthews, D. M., Mangrove and nipah swamps of British North Borneo, Bulletin 3 (1917) Department of Forestry British North Borneo. Revised by Dr. F. W. Foxworthy.

Key to the genera of mangrove-swamp plants.

[Based on superficial characters.]

1. Palms.
   2. Stemless, with underground rhizomes; without spines.. *Nipa*, page 26
   2. Trunks erect with numerous, long, slender spines.. *Oncosperma*, page 30
1. A large coarse fern with pinnate leaves rising in a cluster from the base .... *Acrostichum*, page 26
1. Not palms or ferns.
   2. Leaves pinnate with one to three pairs of leaflets. Large trees with round fruit 8 to 25 centimeters in diameter and containing a few, very large, angular seeds........ *Xylocarpus*, page 30
   2. Leaves not pinnate; fruits not as above.
      3. Leaves opposite.
         4. Herbs or shrubs with spiny-margined leaves.... *Acanthus*, page 76
         4. Leaves not spiny.
            5. Leaves usually pointed at the tip.
               6. Tip of leaf with prominent projection of the midrib. *Rhizophora*, page 56
               6. Tip of leaf without projection of the midrib.
                  7. Petioles usually not over 2 or 3 millimeters in length. *Sonneratia*, page 38
                  7. Petioles usually more than 6 millimeters in length.
                     8. Lower surface of leaves green; with long, slender seedling projecting from the fruit........ *Bruguiera*, page 42
                     8. Lower surface of leaves gray or white; fruit a capsule up to 2.5 centimeters in length and containing a single seed .... *Avicennia*, page 74
            5. Leaves rounded at apex and not notched; mature leaves usually more than 3 centimeters in breadth.
               6. Petioles usually more than 1.5 centimeters long; flowers about 1 centimeter in length........ *Scyphiphora*, page 78
               6. Petioles usually much less than 1.5 centimeters in length; flowers about 5 centimeters long........ *Sonneratia*, page 38
            5. Some or all of the leaves slightly or conspicuously notched at apex.
               6. Petioles very short, much less than 5 millimeters in length. *Osbornia*, page 66
               6. Petioles more than 1 centimeter in length.... *Ceriops*, page 54
      3. Leaves alternate.
         4. Small shrubs; leaves with toothed margin........ *Pluchea*, page 78
         4. Margin of leaves smooth or nearly so.
            5. Tips of leaves usually pointed, or lower surfaces of leaves with a silvery appearance.
               6. Petioles more than 2 centimeters in length; plants with abundant milky juice.
                  7. Leaves more than 15 centimeters long; flowers large, white, terminal .... *Cerbera*, page 70
                  7. Leaves less than 12 centimeters and usually less than 10 centimeters long; flowers very small, from branches below the leaves .... *Excoecaria*, page 34
               6. Petioles less than 2 centimeters in length; plants without milky juice.
                  7. Leaves rounded at the base........ *Heritiera*, page 36
                  7. Leaves pointed at the base........ *Brownlowia*, page 34

5. Apex of leaves rounded and usually notched.
  6. Petioles usually about 2 or more centimeters in length; leaves, stems, and fruits densely covered with small round scales. *Camptostemon*, page 34
  6. Petioles 1 centimeter or less in length.
    7. Fruits shaped like a banana except that the tips are sharply pointed .... *Aegiceras*, page 66
    7. Fruits not shaped like a banana............ *Lumnitzera*, page 62

Key to the genera of mangrove-swamp plants.

[Based on floral characters.]

1. Plant without flowers or seeds, reproduced by means of spores. Family 1, Polypodiaceae; *Acrostichum.*
1. Plants with flowers that produce seeds.
  2. Cotyledon one; leaves parallel-veined......................... Family 2, Palmae.
    3. With erect spiny trunk.. *Oncosperma.*
    3. Without trunk and without spines.. *Nipa.*
  2. Cotyledons two; leaves netted-veined.
    3. Corolla none.
      4. Ovary inferior...................... Family 10, Combretaceae; *Lumnitzera.*
      4. Ovary superior.
        5. Flowers dioecious; plants with milky juice. Family 4, Euphorbiaceae; *Excoecaria.*
        5. Flowers monoecious; plants without milky juice. Family 7, Sterculiaceae; *Heritiera.*
    3. Calyx and corolla both present; the corolla of distinct and separate petals.
      4. Ovary superior.
        5. Stamens numerous, more than twice as many as the petals.
          6. Filaments united, stamens on the outside of a column. Family 6, Bombacaceae; *Camptostemon.*
          6. Filaments free...................... Family 5, Tiliaceae; *Brownlowia.*
        5. Stamens few, never more than twice as many as the petals; inside of small cup-shaped tube. Family 3, Meliaceae; *Xylocarpus.*
      4. Ovary inferior.
        5. Stamens numerous, many times as many as the petals.
          6. Flowers small; calyx lobes imbricate in bud; leaves usually with glandular dots............ Family 11, Myrtaceae; *Osbornia.*
          6. Flowers large; calyx lobes valvate in bud; leaves not glandular dotted............... Family 8, Sonneratiaceae; *Sonneratia.*
        5. Stamens usually twice as many as the petals. Family 9, *Rhizophoraceae.*
          6. Petals four.. *Rhizophora.*
          6. Petals five or six.. *Ceriops.*
          6. Petals eight to fourteen.. *Bruguiera.*
    3. Calyx and corolla both present; the petals more or less united.
      4. Ovary superior.
        5. Stamens opposite the lobes of the corolla, as many as the lobes. Family 12, Myrsinaceae; *Aegiceras.*
        5. Stamens as many as the lobes of the corolla in regular flowers and alternate with the lobes, or sometimes fewer in irregular flowers.

6. Carpels distinct, at least below, sometimes united at apex by the styles; plants with milky juice.
   Family 13, Apocynaceae; *Cerbera.*
6. Carpels entirely united; plants with watery juice.
   7. Fruits drupaceous; flowers small.
      Family 14, Verbenaceae; *Avicennia.*
   7. Fruits capsular, dehiscent; flowers large.
      Family 15, Acanthaceae; *Acanthus.*

4. Ovary inferior.
   5. Flowers not in dense heads; leaves opposite.
      Family 16, Rubiaceae; *Scyphiphora.*
   5. Flowers in dense heads; leaves alternate.
      Family 17, Compositae; *Pluchea.*

DESCRIPTION OF SPECIES

Family 1, POLYPODIACEAE

Genus ACROSTICHUM

ACROSTICHUM AUREUM Linn. (Plate VIII). LAGOLO.

Local names: *Piai* (Agusan); *pakupakuan* (Manila); *lapole* (Tayabas).

Acrostichum aureum occurs in great abundance on open mud flats in the swamp and along tidal streams. The leaves are pinnate, leathery, and from 50 to 200 centimeters in length. The leaflets are from 20 to 50 centimeters long and from 4 to 6 centimeters wide. *Acrostichum aureum* is distributed in the tropics of both hemispheres.

Family 2, PALMAE

Key to the genera.

Stemless, with underground rhizomes; without spines	*Nipa.*
Trunks erect with numerous, long, slender spines	*Oncosperma.*

Genus NIPA

NIPA FRUTICANS Wurmb. (Plates IX, X). NIPA.

Local names: *Sasá, lása, páuid* (Tagalog); *sága* (Sambali), *táta, anipa* (Cagayan); *nípa* (Bikol).

This palm is at once distinguished from all others in the Philippines by its habit and habitat. It occurs along tidal streams throughout the Philippines and, from an economic standpoint, is one of the most important palms in the Archipelago. It is of special interest from the fact that it thrives only in brackish swamps. Nipa has a stout, creeping, subterranean stem or rhizome. The leaves are pinnate, 7 meters or more in length, and occur in erect clusters. Nipa frequently forms a dense mass of vegetation which is very difficult to penetrate. The

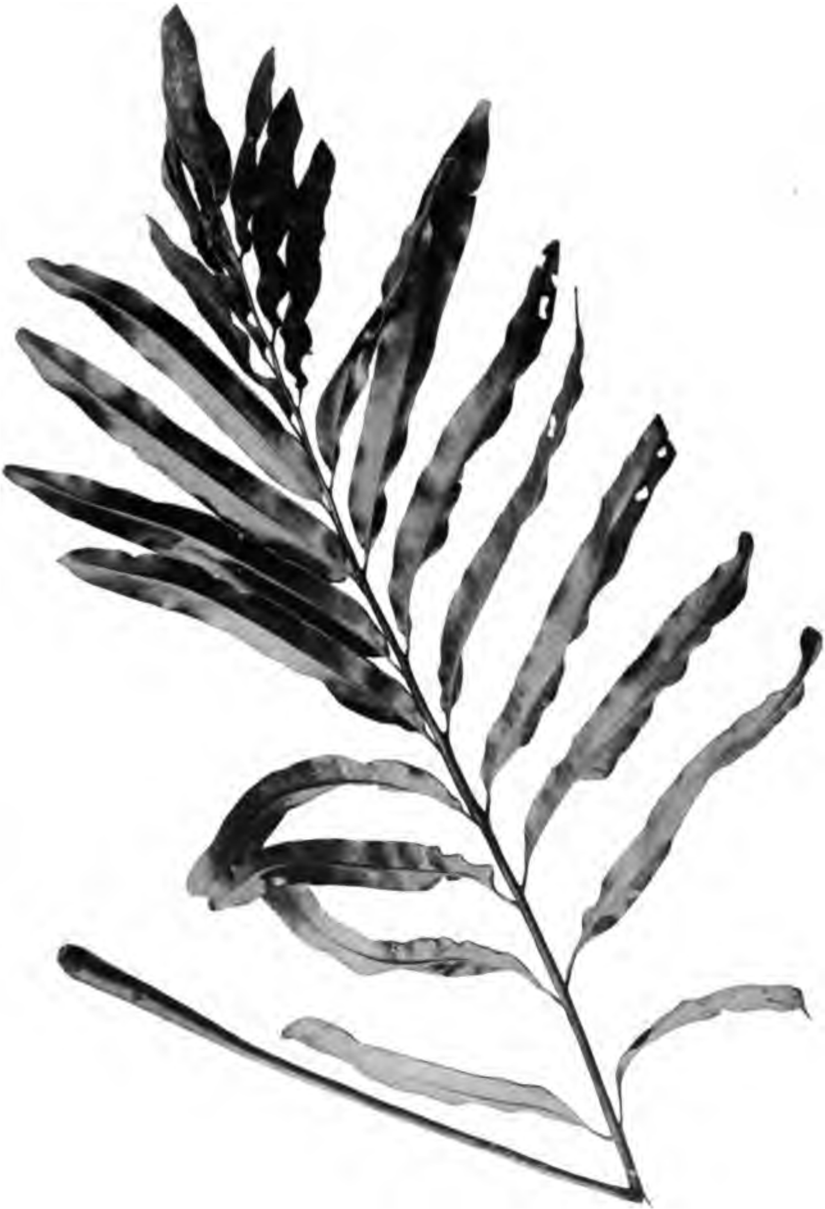

PLATE VIII. ACROSTICHUM AUREUM.

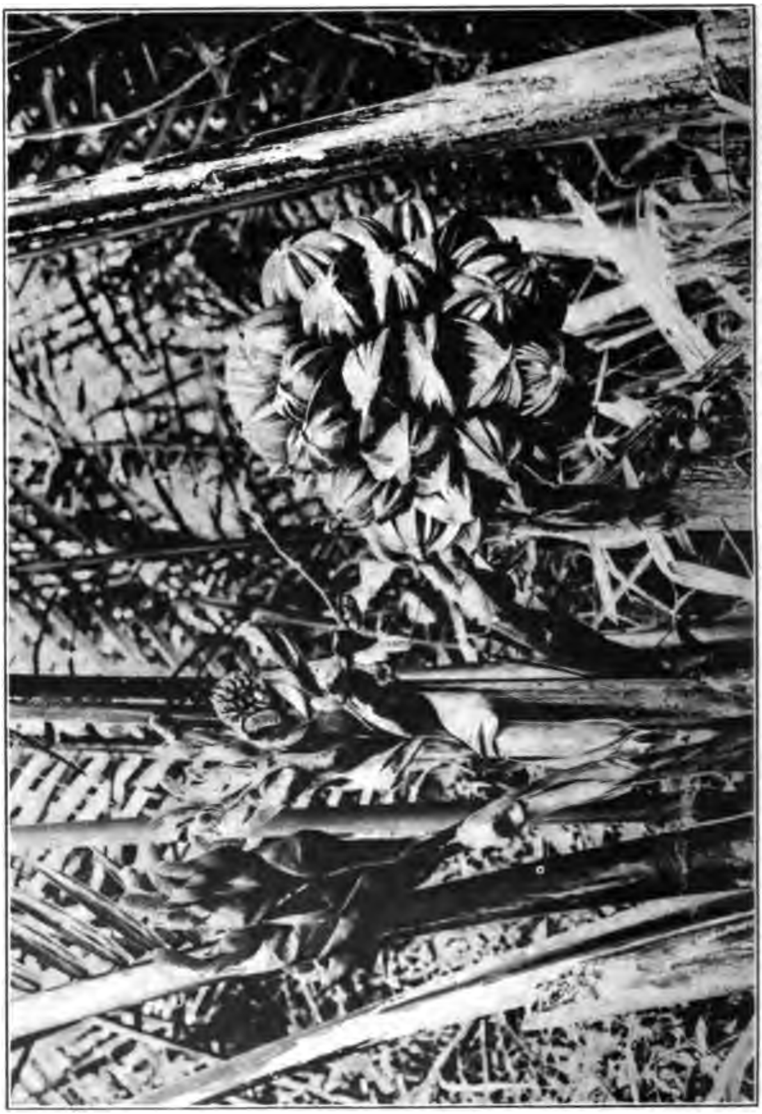

PLATE IX. NIPA FRUTICANS WITH FLOWERS AND FRUIT.

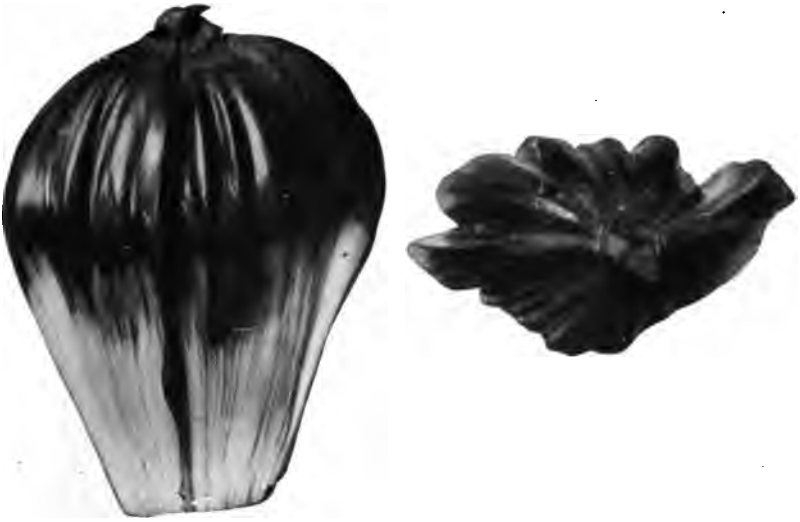

Fig. 1. Fruit of nipa.

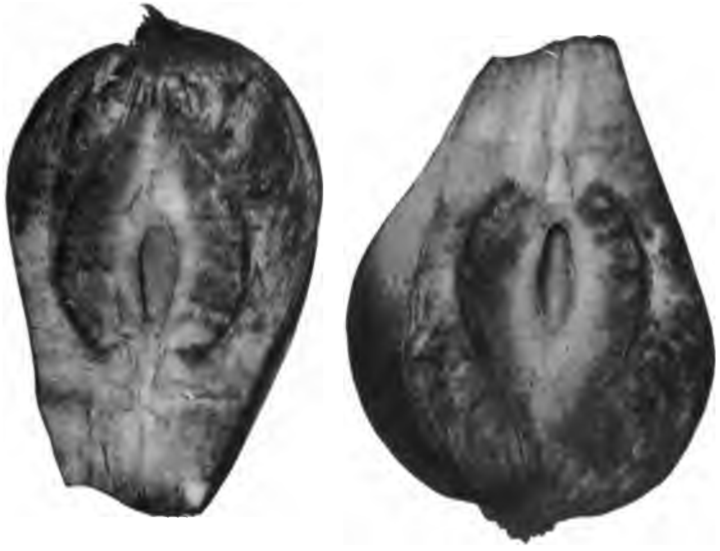

Fig. 2. Section of fruit of nipa.

PLATE X.

fruits are flat and about 12 centimeters long by 10 centimeters broad. The inflorescence is very characteristic, notably the large, globose, fruiting head, which is up to 30 centimeters in diameter and borne on a special erect stalk. This plant apparently has no very definite blooming season, but as a general rule, at least in Bulacan and Pampanga Provinces, flowers during the months of February and March. It takes about four months for the fruit to ripen.

The methods of cultivation of nipa and its economic value as a source of thatching material, alcohol, and sugar will be discussed later.

Genus ONCOSPERMA

ONCOSPERMA FILAMENTOSA Blume. ANIBONG.

Local name: *Aníbong* (Tagalog and Bisaya).

Anibong can be at once recognized by the numerous, long, slender, horizontally spreading, stiff, sharp spines borne on the trunk throughout its length.

Like the other species of the genus, this is a rather tall, slender palm. It often grows subgregariously in favorable habitats, in ravines, or in lowlands back of the mangrove and often within the influence of brackish or salt water. The outer part of the trunk is very hard and durable; and split into narrow pieces is extensively used by the Filipinos, in the regions where it grows, for house floors. It is also used for spear shafts. The bud is edible, either raw or cooked; while in the Malay Archipelago, perhaps also in the Philippines, the fruits are sometimes used as a substitute for areca fruits in preparing buyo for chewing.

Family 3, MELIACEAE

Genus XYLOCARPUS

Key to the species.

Bark light colored, smooth; fruit 17 to 25 centimeters in diameter. *Xylocarpus granatum.*

Bark dark brown, very rough; fruit about the size of a small orange. *Xylocarpus moluccensis.*

XYLOCARPUS GRANATUM Koen. (Plate XI). TABÍGI.

Local names: *Tábigi* (Lanao, Cebu, Tayabas, Guimaras Island, Zamboanga, Negros, Dinagat Island, Camarines, Masbate, Agusan, Sorsogon, Leyte, Marinduque, Panay, Basilan, Palawan, Samar, Cotabato, Culion); *pulit* (Basilan Island); *kulimbáning* (Culion Island); *tambo-tambo* (Zamboanga); *lubanáyong* (Cagayan); *nigi* (Mindoro, Camarines, Palawan, Zambales, Tayabas); *piagáu* (Masbate, Zamboanga).

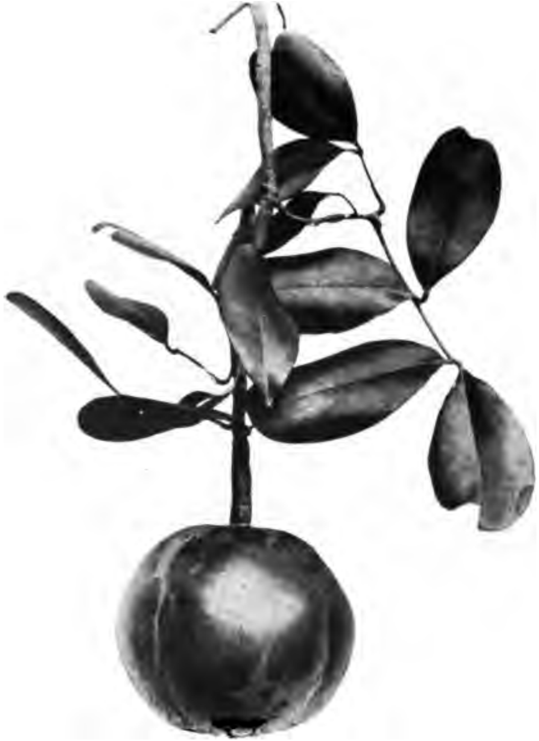

Fig. 1. Xylocarpus granatum with immature fruit.

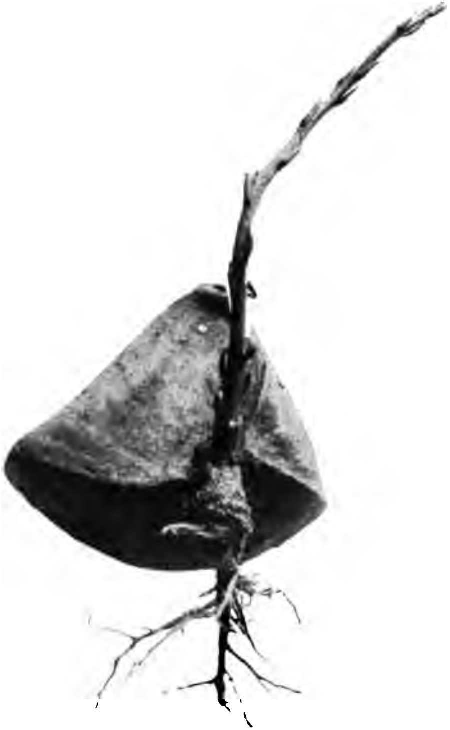

Fig. 2. A germinating seed of Xylocarpus granatum.

PLATE XI.

This is a medium-sized to large tree, reaching a diameter of 100 centimeters, with thin, smooth, and light-colored bark. The bark contains a large amount of tannin. The inner bark is dark red and furnishes a dark red dye. The trunk is usually crooked and very often rotten. The roots frequently extend for a considerable distance through the mud. They are crooked, and the projecting parts are very narrow on top.

The wood is moderately hard and moderately heavy. The sapwood is small in amount, whitish; the heartwood red. The grain is straight or slightly crossed; the texture fine and glossy. The wood seasons very well, shrinking little and checking or warping hardly at all; works easily. It is rarely, if ever, attacked by beetles. It is used for poles; ties; posts; beams, joists, rafters; doors; flooring; all interior finish; high-grade furniture and cabinetwork; among the best and most beautiful cabinet woods in the Islands.

The leaves are alternate and compound with one to three pairs of leaflets. The flowering branches are usually from 3.5 to 7 centimeters in length. The flowers are about 6 millimeters long. The stalks are from 7 to 13 millimeters in length. The calyx has four rounded lobes. The four petals are much longer than the calyx, rounded, the edges overlapping. The fruit is from 17 to 25 centimeters in diameter and round, with a thick, corky, leathery covering, which usually splits into four pieces as the fruit dries. The fruit contains a number of corky, more or less pyramidal seeds, which float, with the small end up, until after germination.

XYLOCARPUS MOLUCCENSIS (Lam.) M. Roem. (Plate XII). PIAGÁU.

Local names: *Piagáu* (Mindoro, Zamboanga, Negros, Cotabato, Palawan, Guimaras Island); *lagut-út* (Guimaras Island); *tabigi* or *tibigi* (Mindoro and Cotabato); *puyugau* (Ticao Island); *sangkuyong* (Moro and Jolo); *piadak* (Palawan).

This species differs from the last in being straighter and taller; with dark, flaky bark; smaller fruits, about the size of an orange; and erect air roots. The wood is generally a little harder and darker in color than that of *Xylocarpus granatum*. The heartwood at the base of the trunk is often rotten. This tree reaches a diameter of 65 centimeters. The wood has the same uses as that of *Xylocarpus granatum*.

The leaves are compound, with two or three pairs of leaflets. The flowering branches are slender and from 7 to 25 centimeters in length. The flowers are similar to those of *Xylocarpus granatum*, but have rather broader petals and a shorter style. The fruit is rounded and about the size of a small orange.

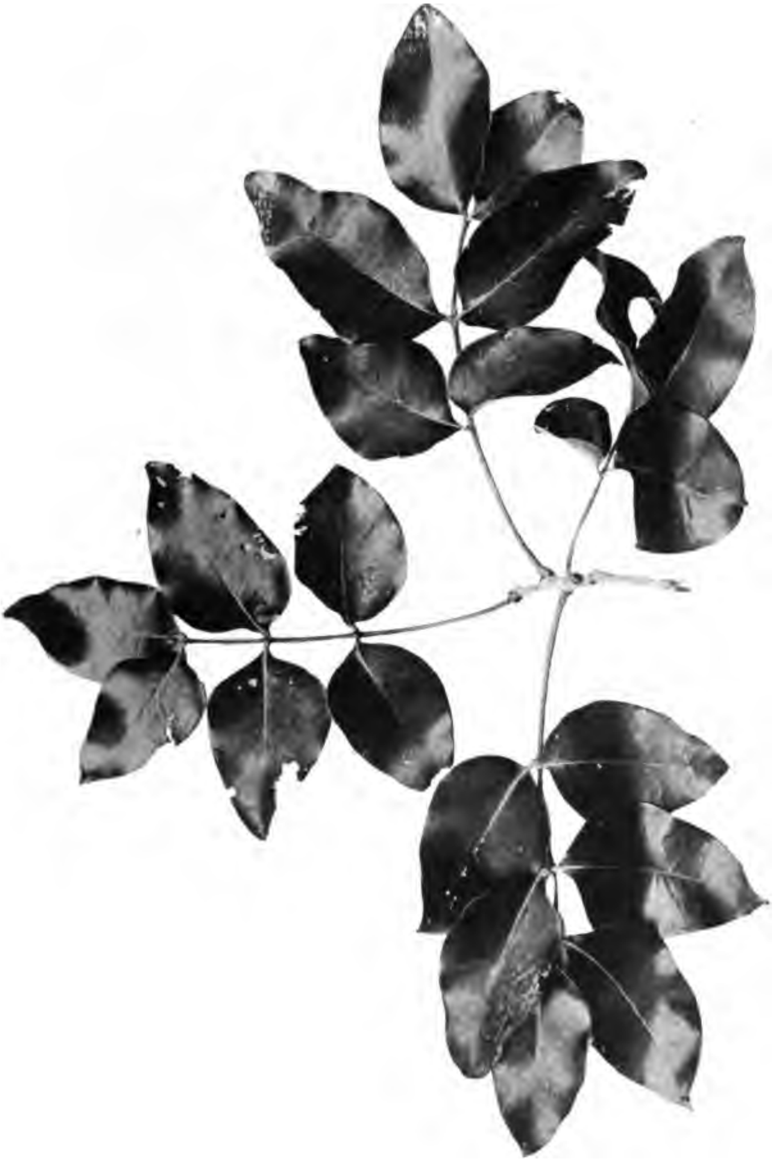

PLATE XII. XYLOCARPUS MOLUCCENSIS.

Family 4, EUPHORBIACEAE

Genus EXCOECARIA

EXCOECARIA AGALLOCHA Linn. (Plate XIII). BUTA-BUTA.

Local names: *Batano* (Pangasinan and Cagayan); *buta* (Basilan, Bataan, Mindoro, and Palawan); *buta-buta* (Bataan and Palawan); *lipata* (Palawan, Agusan, and Camarines); *lipatang-buhay* (Palawan); *alipata* (Negros); *kulasi* (Tayabas and Lanao).

Excoecaria agallocha is a small tree, usually not more than 8 meters in height, growing on firm mud or sand at the edge of the swamp or on relatively firm spots in swamps. The bark is light gray and broadly checked with darker streaks. It contains copious milky sap which is very poisonous, being said even to cause blindness when it touches the eyes.

The leaves are alternate, shiny, pointed at the tip and somewhat rounded at the base, and about 6 to 12 centimeters long. The flowers are very small and are densely crowded on slender flowering branches. The male flowers are found on spikes which grow singly in the axils of the leaves and are from 5 to 10 centimeters long. The female flowers occur on branches which are 2 to 3 centimeters long. There are three sepals, no petals, and three stamens. The fruits are composed of three sections, are somewhat rounded, smooth, and about 5 millimeters in diameter. The wood is pale brownish white, soft, and probably not used for any purpose but fuel.

Family 5, TILIACEAE

Genus BROWNLOWIA

BROWNLOWIA LANCEOLATA Benth. MARAGOMON.

Local name: *Maragomon* (Bisaya).

This species is a shrub or a small tree. The leaves are pointed at both ends; 9 to 15 centimeters long, 3 to 4.5 centimeters wide; the upper surface when mature is smooth and shiny, the lower covered by a dense layer of minute, whitish yellow scales. The inflorescences have few flowers. The flowers are about 6 millimeters long; the stalks about the same length. The calyx is 5 millimeters long, bell-shaped, and divided into three to five lobes. There are five petals, which are longer than the calyx.

Family 6, BOMBACACEAE

Genus CAMPTOSTEMON

CAMPTOSTEMON PHILIPPINENSE (Vidal) Becc. (Plate XIII). GAPAS-GÁPAS.

Local names: *Buñgálon* (Tayabas); *gapas-gápas* (Negros, Capiz. Zamboanga); *dandúlit* (Zamboanga); *balúno* (Zamboanga); *libáto-putí'*, *nigi-putí'* (Tayabas).

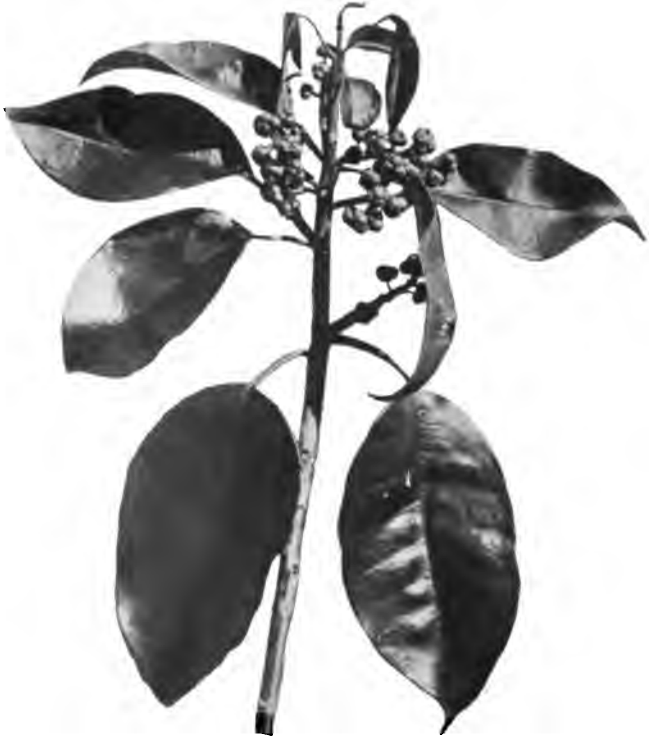

Fig. 1. Excoecaria agallocha with fruits.

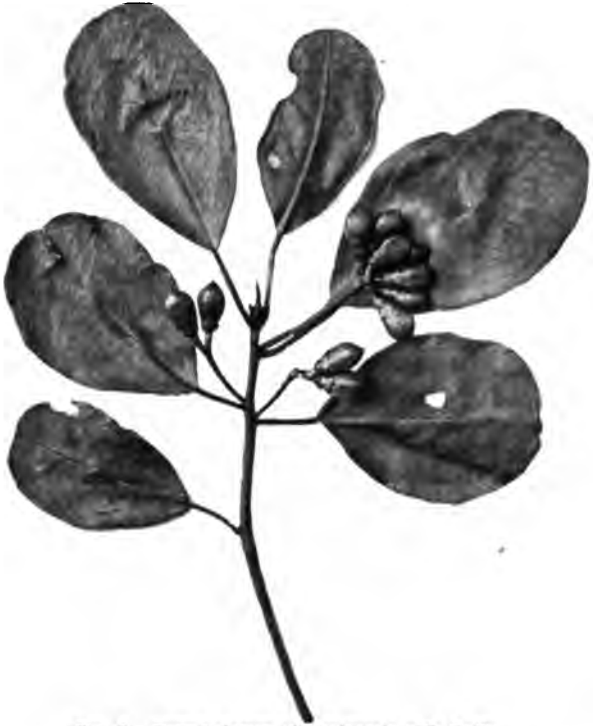

Fig. 2. Camptostemon philippinensis with fruits.

PLATE XIII.

A small tree, 6 to 10 meters high, the vegetative parts, buds, and fruits, covered with numerous small round scales. Leaves alternate, rather thick, crowded at the ends of the branches, margin smooth, apex rounded, base narrowed, 5 to 10 centimeters long, 3 to 6 centimeters wide, petioles 2 to 5 centimeters long. Flowers small, crowded at the tips of short axillary stalks, nearly white, and with five petals. The anthers are few in number and crowded at the apex of a short tube. The fruit is a small, pear-shaped capsule, about 1.5 centimeters long, and contains a few small seeds densely covered with a cottonlike substance.

The wood is moderately hard; of smooth, fine texture; pure creamy-white, but bluing easily in seasoning. It is a pretty wood, but little known and rarely cut except with mixed firewood.

Family 7, STERCULIACEAE

Genus HERITIERA

HERITIERA LITTORALIS Dryand. (Plate XIV). DUÑGON-LÁTE.

Local names: ***Duñgon-láte*** and ***dúñgon*** (Tayabas, Baler, Negros, Butuan, Camarines, Masbate, Lanao, Palawan, Zamboanga, Mindoro, Bataan, Cotabato, Zambales, Manila, Misamis, Leyte, Basilan, Surigao, Palaui Island, Sorsogon, Ticao, Guimaras, Agusan); ***paunapin*** (Cagayan); ***magáyao*** (Cagayan); ***palugápig, paloñgápoi, paronapin, paronápoi*** (Cagayan, Pangasinan, Zambales); ***baut*** (Moro); ***malarúñgon*** (Tayabas); ***paloñgapuy*** (Iloko); ***duñgon-lalao*** (Tayabas); ***bárit*** (Zamboanga); ***dumón*** (Cagayan); ***bayag-kabayo*** (Manila).

This is a tree which grows on the inner part of the swamp and sometimes on dry land just back of the swamp. The bark is light-colored and coarsely furrowed. There is a thin outer layer which peels off readily and leaves a dark brown color. Most of the trees are small and useless, though occasionally large-sized trees are found. It may reach a diameter of about 90 centimeters and have a clear length of 13 meters.

The wood is very hard, heavy, very tough and flexible, but not resilient. The sapwood is up to 6 or 8 centimeters in thickness; in mature trees sharply marked off from heartwood. The heartwood is reddish brown to dark chocolate, often containing masses of stony deposits in old knots and heart cracks. The grain is crossed and sometimes curly; texture fine, dense, smooth, but not glossy. Logs and large timbers are liable to split deeply in seasoning; boards less liable to split, but must be piled carefully and heavily loaded to prevent warping. It is very difficult to work, both on account of its hardness and toughness, and because it dulls tools badly, even when no stony deposits are met. The heartwood is rarely attacked even by termites and only eaten slowly by teredos. The sapwood is rapidly

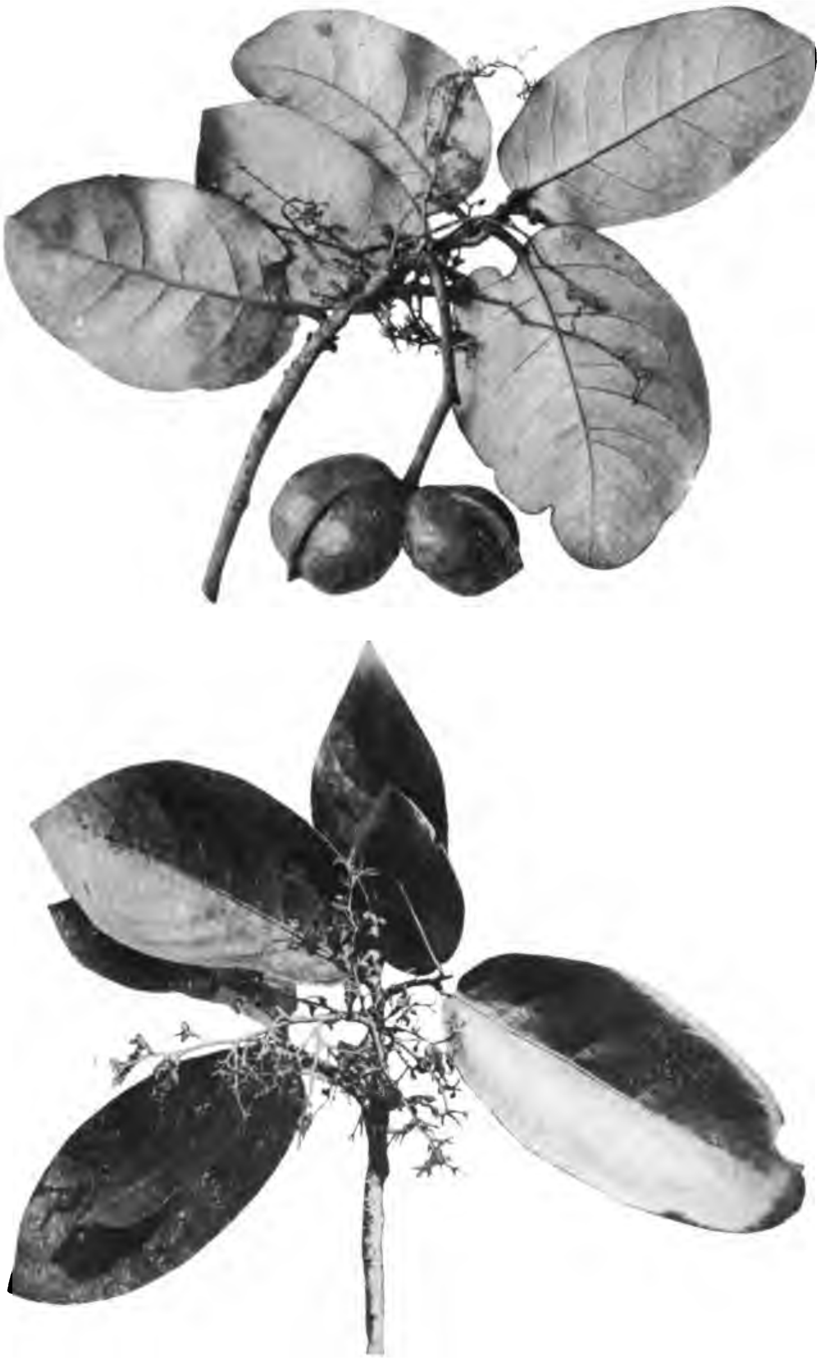

PLATE XIV. HERITIERA LITTORALIS, FRUITS AND FLOWERS.

attacked by both insects and fungi. The wood is used for piling; posts; foundation sills; ties, paving blocks, bridges, wharfs, and ship buildings; beams, joists, rafters; hubs, spokes, felloes, and axles; capstan bars and other levers; ax, pick, and other tool handles; mallets and other wooden tools; recommended for steamed bent work where great strength and durability are required.

The leaves are 10 to 20 centimeters long, alternate, simple, dark shiny green on the upper surface and silvery below. The flowering branches are borne in the axils of the leaves and are hairy and from 7 to 15 centimeters long with numerous flowers. The flowers are 5 millimeters long, unisexual, yellowish green, and bell-shaped. The flower has no petals. The calyx is usually 5-toothed. The anthers are borne in a ring. The fruit is hard, woody, smooth, shiny, 4 to 8 centimeters long, and boat-shaped.

Family 8, SONNERATIACEAE

Genus SONNERATIA

There are two species of *Sonneratia* in the Philippine mangrove swamps, *Sonneratia alba* and *Sonneratia caseolaris*. These two species can be readily distinguished by the shapes of the leaves. The leaves of *Sonneratia alba* are narrow and pointed at the apex, while those of *Sonneratia caseolaris* are about as broad as long and rounded at the apex.

Key to the species.

Leaves pointed at apex	*Sonneratia alba*.
Leaves rounded at apex	*Sonneratia caseolaris*.

SONNERATIA ALBA Sm. (Plate XV). **PEDADA.**

Local names: *Payar* (Pangasinan); *palapát*, *palata*, *pagatpát*, and *hikau-hikauan* (Bataan); *pagatpát* (Manila, Bataan), *lukabban*, *ilukábban* (Cagayan).

This species is a small tree occurring along the upper stretches of tidal streams. The fruit is slightly acid and is used as an article of food and also for making vinegar. This tree rarely reaches a height of more than 9 meters. One individual with a diameter of 80 centimeters has been reported. The air roots and leaves are distinctly smaller than those of *Sonneratia caseolaris*. The air roots are sometimes used for the manufacture of wooden soles of shoes. The bark contains a moderate proportion of tannin, but is not often used as other species richer in tannin are more readily available.

The wood is whitish and moderately hard. It rarely, if ever, forms heartwood and is cut only with mixed inferior firewoods.

The smallest branches are jointed and four-angled. The leaves

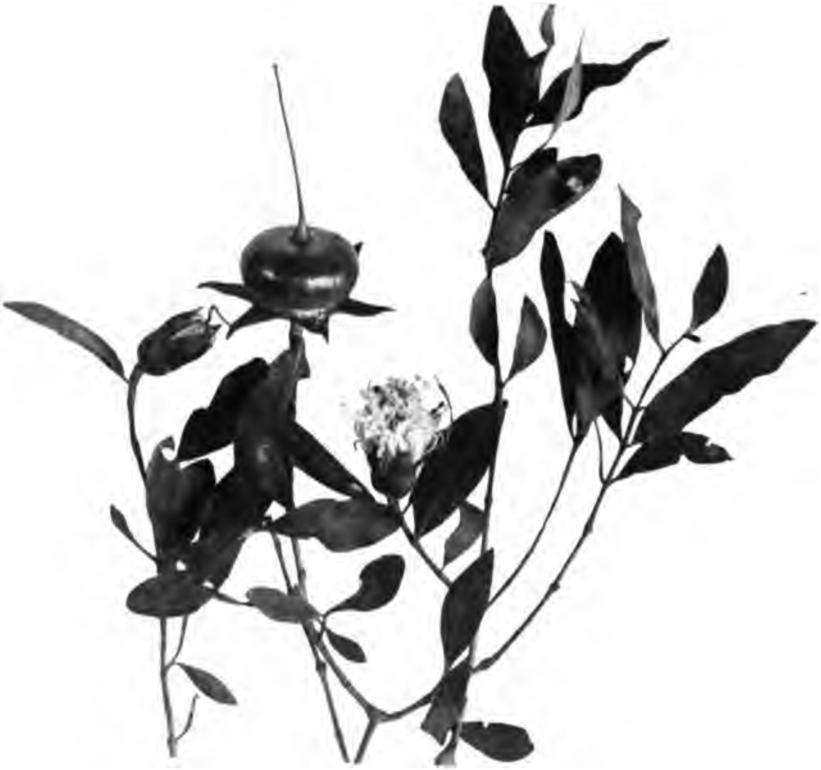

PLATE XV. SONNERATIA ALBA, FRUIT AND FLOWER.

are thick and leathery, narrow, and taper to a broad, short petiole. They are from 4 to 10 centimeters long and from 2 to 4 centimeters wide. The flowers occur singly; the calyx is green, 2.5 to 3 centimeters long, and divided into six to eight angular lobes which are longer than the calyx tube. The petals are six in number, narrow, pink or white, and about as long as the calyx segments. The stamens are very numerous and the style long. The fruit is hard, 3 to 4 centimeters in diameter, rounded but depressed at the apex; the base is surrounded by the calyx tube, the lobes of which still persist when the fruit is mature. The fruit contains many seeds.

SONNERATIA CASEOLARIS (Linn.) Engl. (Plates XVI, XVIII). PAGATPÁT.

Local names: *Pagatpát* (Cebu, Camarines, Tayabas, Cagayan, Samar, Agusan, Basilan, Zambales, Cotabato, Palawan, Mindoro, Zamboanga, Panay, Guimaras Island, Negros, Leyte, Bataan, Lanao); *bunayon* (Dinagat Island); *patpát* (Butuan); *lukabban, ilukabbán, lukabbaán* (Cagayan); *pirara* and *palalan* (Cotabato); *bun͠gálon* (Masbate).

This is a tree of the outer part of the swamp, and often occurs even on exposed reefs. The trunk is swollen at the base, at least when young. The air roots are usually from a few centimeters to 60 centimeters in length. In some places along river banks, where the tree is growing in soft mud, they are much longer, and have been known to reach a length of more than 2 meters. The bark is very dark gray. *Sonneratia caseolaris* may reach a diameter of 175 centimeters and a clear length of 26 meters.

The wood is moderately hard and moderately heavy to heavy. The sapwood is 3 to 8 centimeters thick, light grayish brown; the heartwood light brown to dark chocolate. When wet or under varnish, the heartwood of old mature trees looks almost black. The grain is straight or very slightly crossed; the texture fine, very homogeneous, smooth, but not glossy; it has a distinct salty taste and a fishy or swampy odor, especially when fresh. Boards season fairly well, but logs and heavy planks are liable to check internally. It is easy to work. It lasts well in the ground and even the sapwood is rarely attacked by insects; the heartwood is said to resist teredos very well. It is used for piles; posts, poles; ties; paving blocks; ship, bridge, and wharf building; general strong construction; doors; siding, sheathing, ceiling, flooring, and all kinds of interior finish; ship planking and decking; furniture and cabinetwork; and musical instruments. The wood contains a small amount of salt, making the use of copper nails and screws necessary. The air roots are used as floats for fish nets and, being corky in texture, are

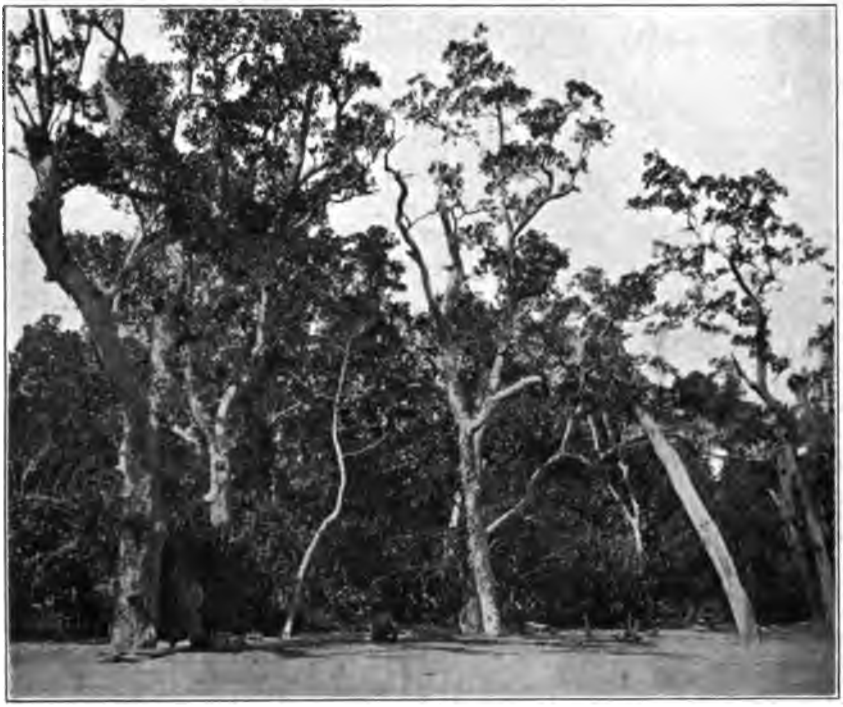

Fig. 1. Sonneratia caseolaris on an open coast.

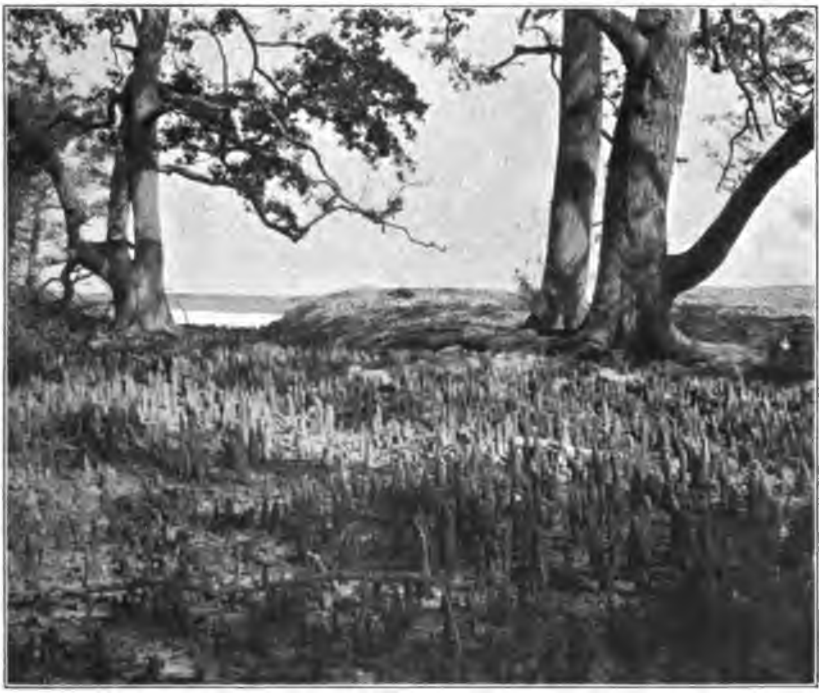

Fig. 2. Air roots of Sonneratia caseolaris.

PLATE XVI.

employed in the manufacture of inner soles for shoes and can be used as a substitute for cork or pith.

The small branches are more rounded than in *Sonneratia alba*. The leaves are thick and leathery, rounded at the apex, 6 to 10 centimeters long, and nearly as wide as long. Two or three flower buds are usually found together. The calyx is green, leathery, 3 to 4 centimeters long, and divided into six to nine narrow segments, which are equal in length to the calyx tube or longer. The petals are white, narrow, and fall off very early; they are nearly as long as the calyx segments. Sometimes there are no petals. The stamens are very numerous and the style long. The fruit is hard, rounded, depressed at the apex, 3 to 4 centimeters in diameter, and surrounded nearly to the middle by the calyx tube, the lobes of which are still present when the fruit is mature. The fruit contains many seeds.

Family 9, RHIZOPHORACEAE

The family Rhizophoraceae is the most important one in the mangrove swamps and contains by far the largest number of species. The members of this family in the swamps are distinguished at once from all other species by the fact that the seed germinates and produces an elongated seedling before the fruit drops from the tree. This character is shown clearly in the illustrations of the members of this family. The conspicuous part of the seedling that projects from the fruit is the radicle or young root, which is very much longer than the plumule or young shoot. The family Rhizophoraceae is represented in the swamps by three genera; *Rhizophora, Bruguiera,* and *Ceriops.*

Trees of the genus *Rhizophora* are easily distinguished from all other trees in the swamps by the very numerous prop roots which grow out from the trunk and branches. These are shown very clearly on Plate I. The genera *Bruguiera* and *Ceriops* can be separated by the shapes of the leaves, which in *Bruguiera* are pointed at the apex and in *Ceriops* are rounded and notched at the apex.

Key to the genera.

1. Leaves pointed at apex.
   2. Tip of leaves with prominent projection of midrib................ ***Rhizophora.***
   2. Tip of leaves without projection of midrib................................ ***Bruguiera.***
1. Leaves rounded and notched at apex... ***Ceriops.***

Genus BRUGUIERA

The genus *Bruguiera* is represented in the Philippines by four species: *Bruguiera conjugata* (busain), *B. cylindrica* (potótan-lalaki), *B. sexangula* (potótan), and *B. parviflora* (lan-

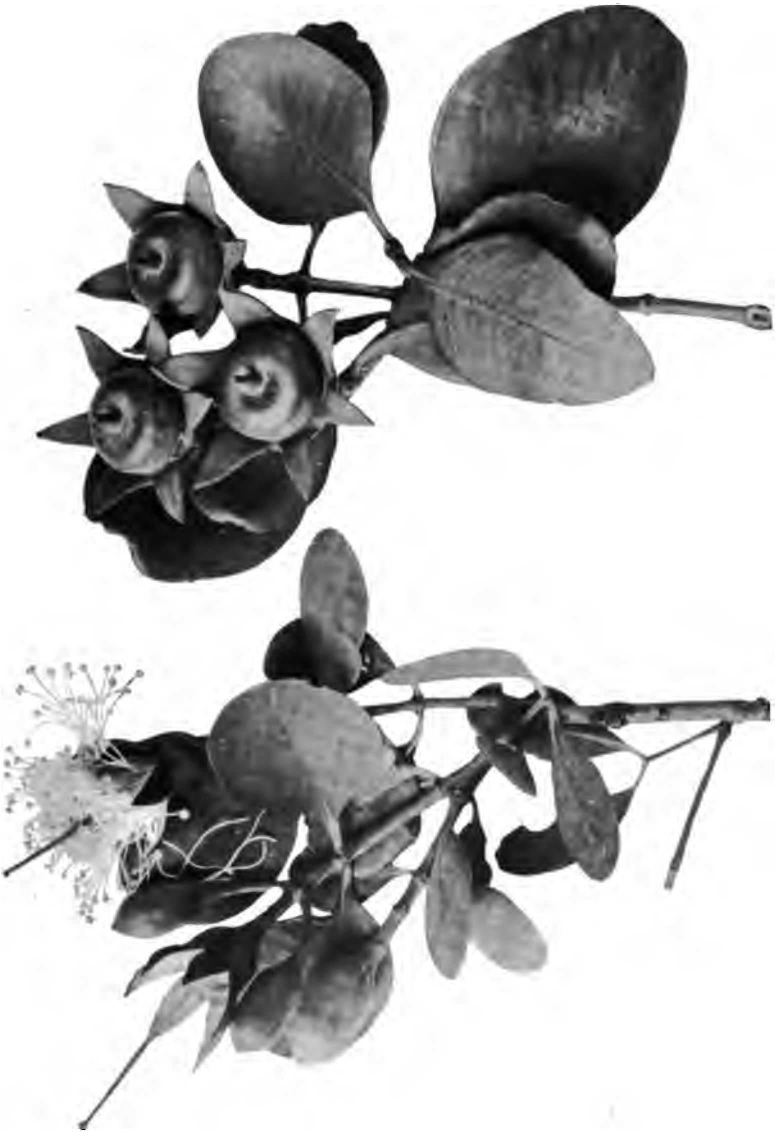

PLATE XVII. SONNERATIA CASEOLARIS, FLOWER AND FRUITS.

garai). The wood is hard and heavy to very heavy; the sapwood 2 to 4 centimeters thick, sometimes merging gradually into the darker heartwood, but often almost indistinguishable from it; the heartwood is pale dull red or reddish brown, sometimes with very irregular, narrow but ill-defined, dark streaks. The grain is straight and the texture fine. Beautiful conspicuous silver grain occurs on radial sections. Logs check badly in seasoning, but sawn lumber seasons without much checking and warping if properly stacked under a roof. The wood is hard to saw, but otherwise easy to work. It is said to last well in wet situations, is rarely attacked by insects, and is said to resist teredos for as much as seven or eight years. It has much the same uses as that of the genus *Rhizophora.*

The leaves of *Bruguiera* are usually leathery in texture, oblong, and entire. The flowers are rather large and are found in the axils of the leaves. The calyx is split into eight to fourteen lobes. The petals are oblong, and equal in number to the calyx-lobes, two-lobed or notched at the apex, embracing the stamens by pairs. There are sixteen to twenty-eight stamens. The ovary is two- to four-celled. The fruit is included in or joined to the calyx tube, is one-celled, one-seeded. The seed germinates on the tree.

The different species of *Bruguiera* are readily distinguished either in flower or fruit except in the case of *Bruguiera conjugata* and *Bruguiera sexangula,* which have forms intermediate in character between typical specimens of the two species. The flowers of *Bruguiera conjugata* and *Bruguiera sexangula* are large, 2.5 to 5 centimeters long; while those of *Bruguiera parviflora* and *Bruguiera cylindrica* are small and about a centimeter in length. The flowers of *Bruguiera conjugata* are typically red with the calyx divided into twelve to fifteen lobes; while the flowers of *Bruguiera sexangula* are usually yellow with the calyx divided into ten lobes. As the calyx-lobes of *Bruguiera* are persistent, the fruits of these two species can be readily distinguished from those of the other two species of the genus by the long calyx-lobes, while the two species themselves can be separated according to the number of the lobes of the calyx. *Bruguiera cylindrica* and *Bruguiera parviflora* can easily be distinguished by the fact that the inflorescences of *Bruguiera cylindrica* bear two or three flowers, while those of *Bruguiera parviflora* have two to five flowers. The petals of *Bruguiera parviflora* are yellow with a brown border at the tip and those of *Bruguiera cylindrica* white. The fruits of these two species are readily distinguished by the fact that in *Bruguiera cylin-*

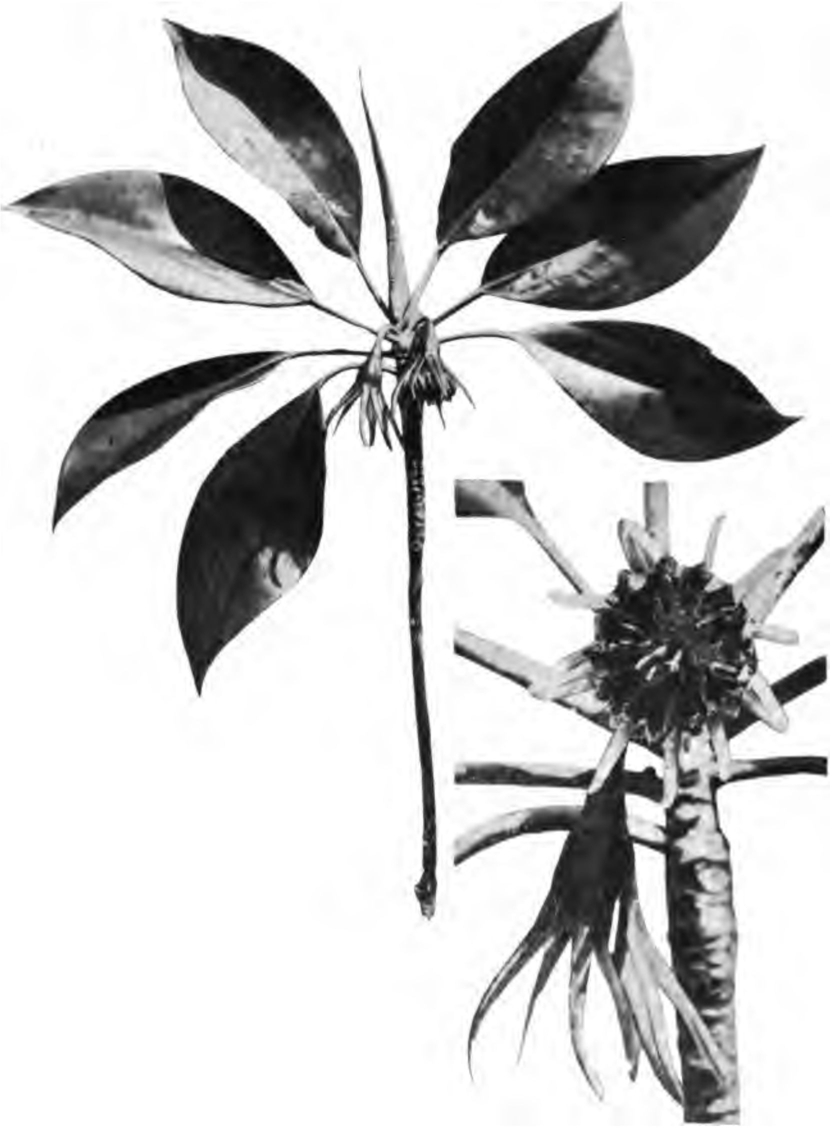

PLATE XVIII. BRUGUIERA CONJUGATA WITH FLOWERS.

drica the calyx-lobes are bent away from the tip of the fruit, while those of *Brugiera parviflora* are erect.

Key to the species.

1. Flowers yellow or red, 2.5 to 5 centimeters long; seedlings more than 6 millimeters in diameter; inflorescences with one flower each.
    2. Flowers usually red .... *Bruguiera conjugata.*
    2. Flowers usually yellow .... *Bruguiera sexangula.*
1. Flowers greenish yellow, about 1 centimeter in length; seedlings less than 6 millimeters in diameter. Inflorescences with two to five flowers.
    2. Sepals bent back from the apex of the fruit .... *Bruguiera cylindrica.*
    2. Sepals erect on fruit, less than one-fourth the length of the ovary. *Bruguiera parviflora.*

BRUGUIERA CONJUGATA (Linn.) Merr. and B. SEXANGULA (Lour.) Poir.

These species are very similar, the chief difference between the two being in the color of the flowers, red in the first case and yellow in the second. These are the largest trees among the true mangroves. Full-grown individuals are from 40 to 65 centimeters in diameter and from 18 to 23 meters in height. The trees have an erect habit and thick-ridged, very dark, almost black bark, which contains many large, brown, corky pustules. The inner bark is of much the same character and appearance as that of bakáuan and contains about the same or a slightly larger amount of tannin.

The wood is very much the same in structure and appearance as that of bakáuan, except that it is lighter red. At a short distance from the base of the trees and extending out to a distance often as great as 5 or 6 meters are many air roots or knees, which are formed by roots bending upward and may extend 45 centimeters into the air. The seedlings are stouter and blunter than in the other trees of the family. They germinate and grow to a length of 15 to 25 centimeters before dropping from the tree.

BRUGUIERA CONJUGATA (Linn.) Merr. (Plate XVIII). BUSAIN.

Local names: *Potótan* (Mindoro, Bataan, Tayabas, Negros, Leyte, Zamboanga, Basilan, and Cagayan); *busai-ing* (Tayabas); *bakáu* (Tinago Island and Zambales); *bakáuan* (Mindoro); *busi-ing* (Mindoro); *bakáo* (Negros); *busáin* or similar forms (Mindoro and Tayabas).

The leaves of *Bruguiera conjugata* are elliptic or elliptic-oblong, pointed at the tip, the base wedge-shaped. When dry the upper surface is shiny, the lower surface dull. The flowers occur singly in the axils of the leaves and are 3 to 4 centimeters in length and when fully opened slightly over 3 centimeters in breadth. The calyx is bell-shaped, leathery in texture and

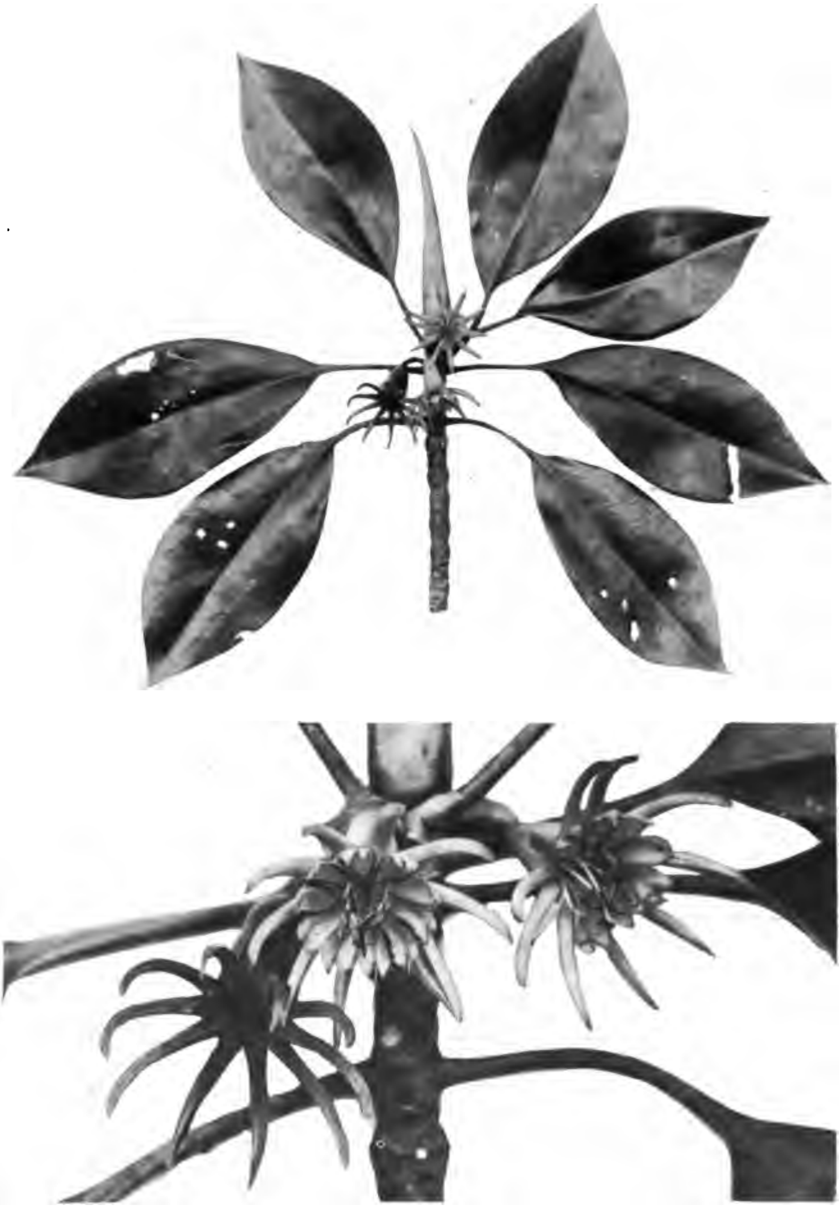

PLATE XIX. BRUGUIERA SEXANGULA WITH FLOWERS.

cut for half its length into narrow pointed teeth, usually twelve to fifteen in number. The petals are slightly shorter than the calyx-lobes and equal to them in number, two-lobed at the apex and with two to four bristles at the point of each lobe, hairy at the base, otherwise smooth or nearly so. Opposite each petal are two stamens, which are shorter than the petals. Each alternate filament is short. The fruit is small; it is found in the bottom of the calyx tube and contains a single seed which germinates in situ, forming a cylindrical root 30 to 60 centimeters in length. *Bruguiera gymnorrhiza* Lam. is a synonym of *B. conjugata* (Linn.) Merr.

BRUGUIERA SEXANGULA (Lour.) Poir. (Plates XIX, XX). Potótan.

Local names: *Potótan* or *putútan* (Tayabas, Zamboanga, Mindoro, Masbate, Misamis, Cotabato, and Palawan); *tagasa* (Bataan); *busáin, busáing,* etc. (Mindoro, Tayabas, Lanao, and Zamboanga); *sagasa* (Cagayan); *álay* (Palawan); *lagásak* (Palaui); *bakáuan* (Manila); *sagasak* (Palaui Island); *langari* (Basilan); *potótan-babae* (Palawan and Bataan); *bakáuan-lalaki* (Bataan); *kalabayuan* (Bataan); *balinsaráyan* (Tayabas).

The leaves of *Bruguiera sexangula* are pointed at the tip, and wedge-shaped at the base; the upper surface is shining, the nerves faint; the lower surface is reddish-brown when dry, the veins are very faint or obsolete, but the midrib is prominent. The flowers are yellow, sometimes tinged with orange, and occur singly in the axils of the leaves. They are usually 3 to 4 centimeters in length and when fully opened about 2.5 centimeters in breath. The calyx is similar to that of *Bruguiera conjugata*, but the lobes are usually only ten in number. The petals are about half the length of the calyx-lobes and deeply divided into two parts, with a stout bristle in the angle between the two narrow lobes, and sometimes with two bristles at the end of each lobe. The edges are densely clothed with stout white hairs. The fruit is similar to that of *Bruguiera conjugata*, except that the germinating root is shorter.

Bruguiera eriopetala W. & A. is a synonym of *Bruguiera sexangula* (Lour.) Poir.

BRUGUIERA CYLINDRICA (Linn.) Blume (Plates XXI, XXII). Potótan-laláki.

Local names: *Bakáuan* (Mindoro); *biús* (Cotabato); *busáin* (Mindoro); *hiñgáli* (Negros); *lañgárai* (Cotabato); *magtoñgóg* (Masbate); *potótan* and *potótan-laláki* (Tayabas and Mindoro); *tañgal-babák* (Mindoro); *kalapínai* (Union); *buis* (Moro); *tañgálan* (Mindoro); *biuis* (Pangasinan); *magtañgúd* (Masbate); *biuas* (Bataan).

Bruguiera cylindrica has flowers intermediate in size between those of *Bruguiera conjugata* and *Bruguiera parviflora*. The tree is usually of low growth, otherwise it is much like *Bruguiera*

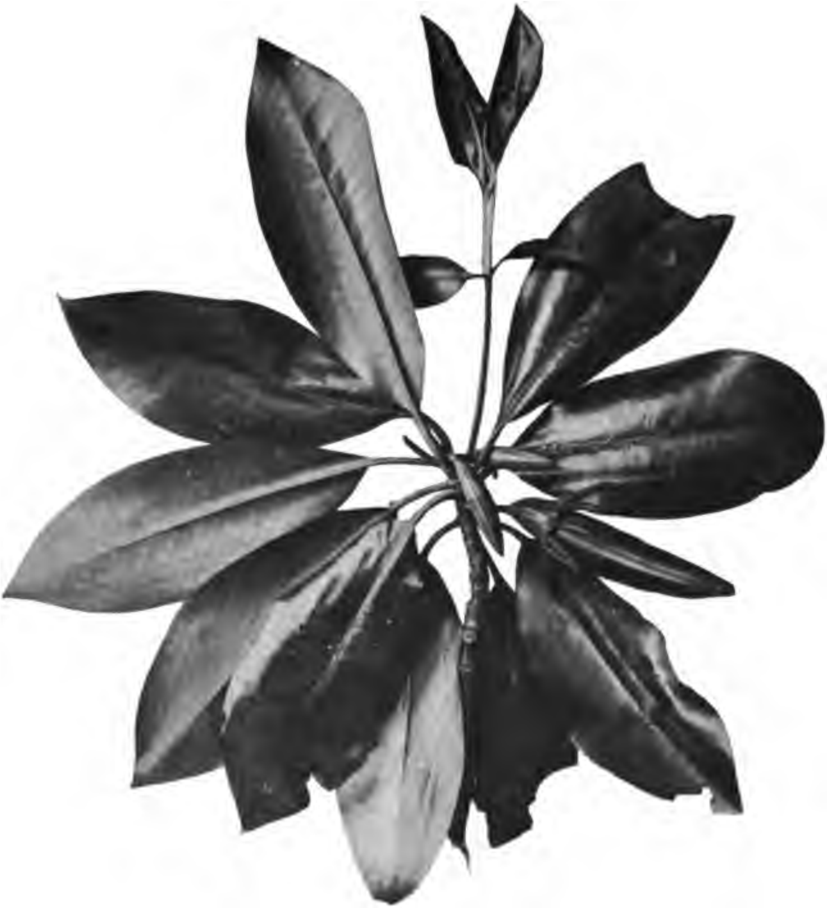

PLATE XX. BRUGUIERA SEXANGULA WITH IMMATURE FRUIT.

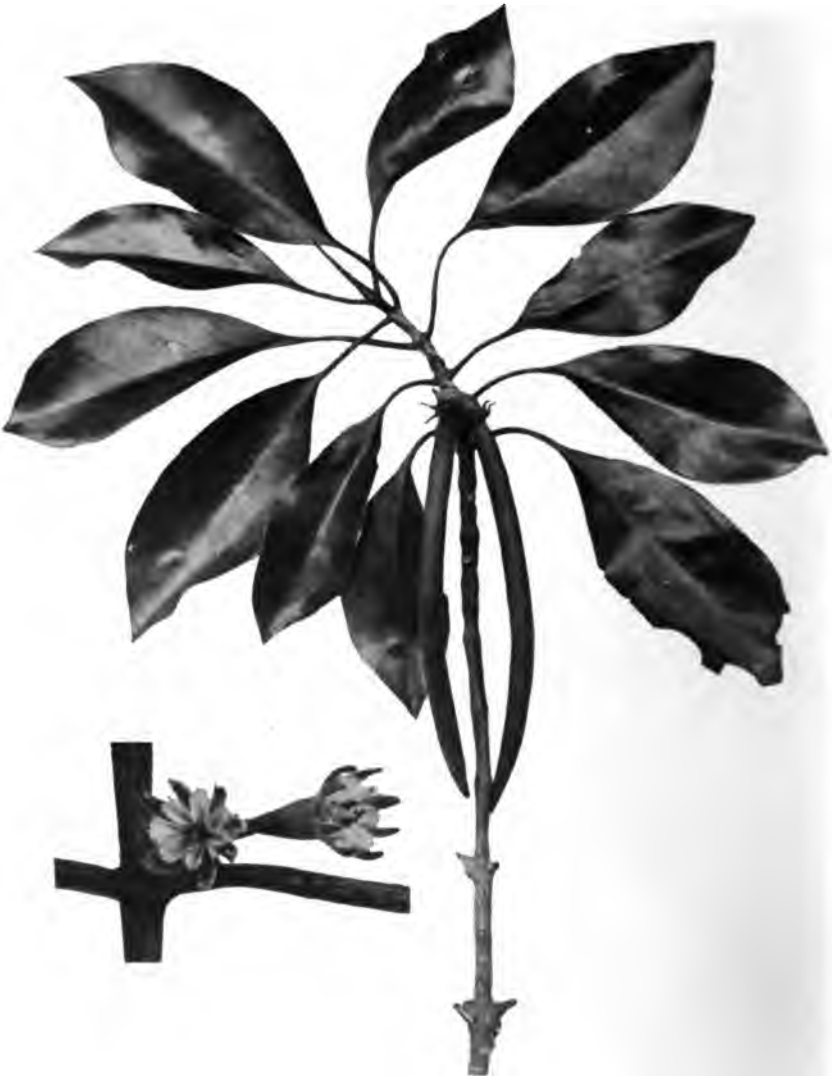

PLATE XXI. BRUGUIERA CYLINDRICA, FRUITS AND FLOWERS.

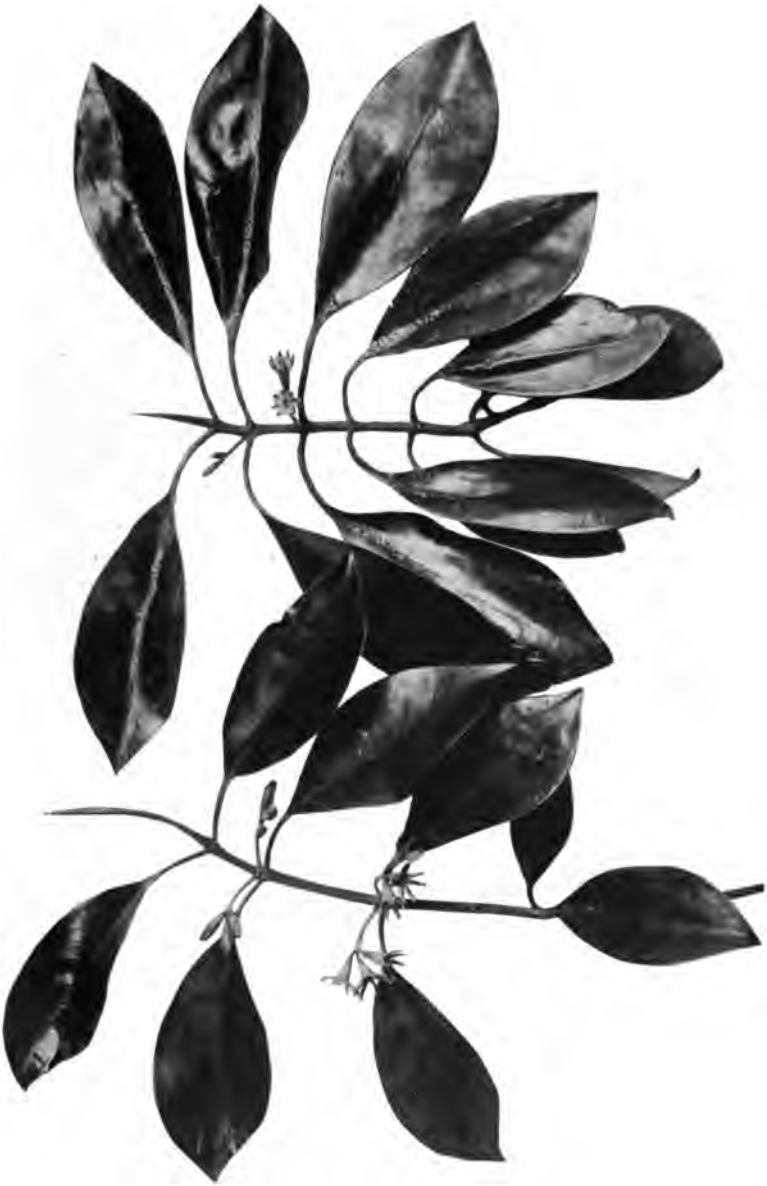

PLATE XXII. BRUGUIERA CYLINDRICA WITH FLOWERS.

parviflora. This species occurs in the Philippines in an exceedingly small amount. Swamps are frequently found which do not contain it, and it is usually of small size.

Bruguiera cylindrica has rather thin leaves. They are soft, 7 to 12 centimeters in length, shiny, and narrowed at both ends. The flowering stalks are found in the axils of the leaves; they are usually shorter than the petioles and bear two to three flowers. The flowers are greenish, about 1 centimeter long and slightly over a centimeter broad. The calyx is green and divided into seven or eight narrow fleshy lobes. The petals are white, equal in number with, but shorter than, the calyx-lobes. The apex of each petal is divided into two lobes; the margins have scanty white hairs outside; the apices are rounded and each is crowned with from three to five brown bristles, while one bristle is found in the angle between the two lobes. The stamens are sixteen in number and unequal in length. The germinating root is cylindrical and reaches a length of 15 to 20 centimeters before the seed falls from the tree. *Bruguiera caryophylloides* Blume. is a synonym of *Bruguiera cylindrica* (Linn.) Blume.

BRUGUIERA PARVIFLORA W. & A. (Plates XXIII, XXIV). LAÑGARAI.

Local names: *Potótan* (Tayabas, Cagayan, Zamboanga); *hañgálai* or *hañgárai* (Mindoro, Masbate, Leyte, Iloilo, Negros); *hiñgálai* (Polillo); *lañgárai* or *lañgári'* (Zamboanga, Tayabas, Masbate, Negros, and Zambales); *bakáuan-laláki* (Batangas); *bubutigan, biosan* (Samar).

Bruguiera parviflora is a tall, slender tree which is often found in solid stands in the interior of the swamp. Trees 15 to 30 centimeters in diameter and 12 to 18 meters in height are full grown, but trees up to 55 centimeters in diameter are found. The bark is gray, hard, and thick, and has broad, smooth ridges. The air roots are similar to those of *Bruguiera conjugata* and *B. sexangula,* but usually smaller; the wood, except for being lighter in color, is also much like that of these two species.

The seedling is of the same color as the leaves, slender and nearly cylindrical. The roots of the seedling grow to about 10 or 12 centimeters in length before the seed drops from the tree.

The leaves of *Bruguiera parviflora* are yellowish green, 6 to 10 centimeters in length, and rather narrow, particularly at the base. The upper surface is shiny, the lower dull. The flowering shoots are in the axils of the leaves and bear two to five yellowish green flowers. The whole flowering shoot, including the flowers, is considerably longer than the petioles of the leaves. The flowers are about a centimeter in length and about 6 millimeters in breadth. The calyx tube is cylindrical and ends in eight pointed lobes about one-fourth the length of the calyx tube.

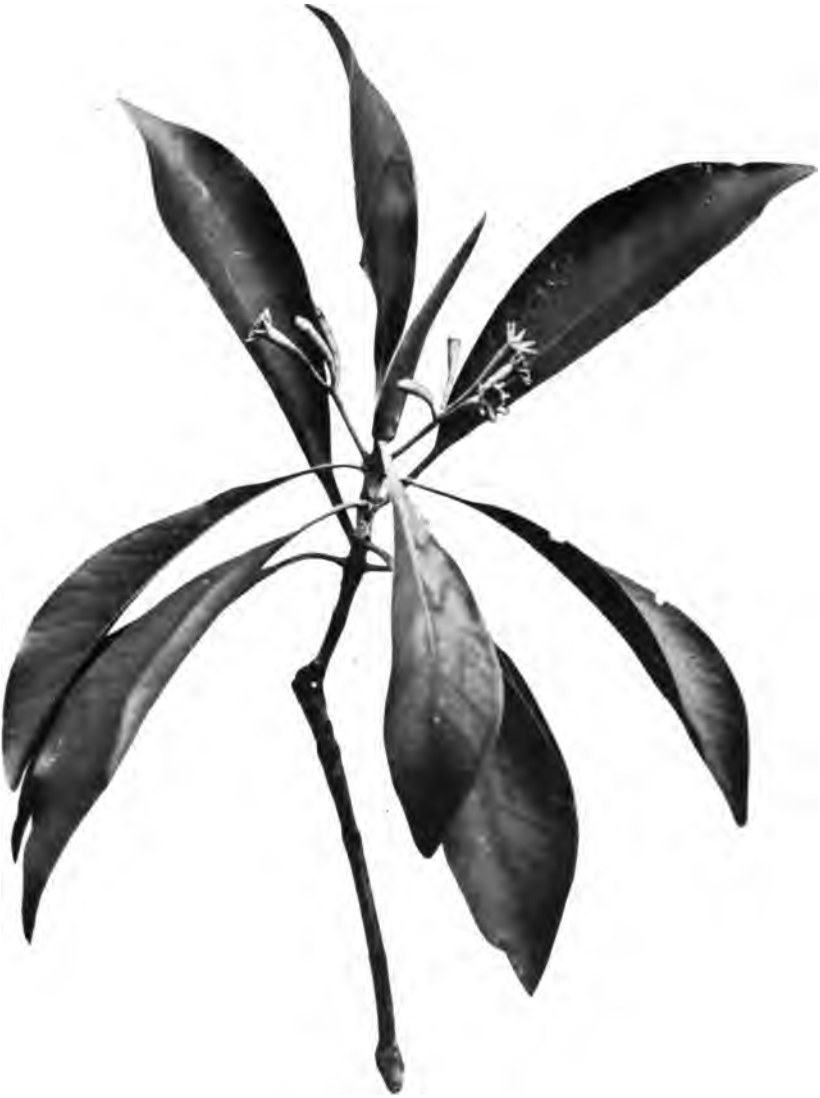

PLATE XXIII. BRUGUIERA PARVIFLORA WITH FLOWERS.

The petals are the same in number as the calyx-lobes but shorter. They are yellow with a dark brown border at the tip. They are two-lobed and each bears three or four hairs, while a single hair is found between two lobes; otherwise the petals are smooth. The stamens are sixteen in number and of unequal size; two are embraced by each petal.

Genus CERIOPS

The two species of *Ceriops*, *C. tagal* and *C. roxburghiana*, are known as tan͠gal. They are separated only by very minute floral characters. Tan͠gál is a small tree with rather smooth, light gray or brown bark, which is perforated in many places by dark-colored lenticels. Below the outer corky layer, there is more or less orange color. The bark contains a high percentage of tannin. The trunk flares at the base. A short distance from the trunk some of the roots bend upward to form small knees.

The sapwood is small in amount and scarcely distinct from the heartwood. The heartwood is very hard and heavy, orange red, changing on exposure to reddish brown. It gives an iridescent orange-red color to water. The grain is straight and the texture fine and dense, taking a smooth, almost polished surface under sharp tools. It does not check badly, but is somewhat liable to warp in seasoning and is not difficult to work except for its hardness. The wood is used for much the same purposes as that of *Rhizophora*.

The leaves are leathery in texture, opposite, and wider toward the apex than near the base. They are notched at the apex. The flowers are small and light greenish yellow. The calyx has five or six lobes. The petals, five or six in number, are inserted at the base of a ten- to twelve-lobed fleshy disk. There are ten to twelve stamens, whose stalks are inserted between the lobes of the disk. The style is short and the stigma simple. The seedlings are angled in cross section and may reach a length of about 35 centimeters before falling from the tree.

Tan͠gál is found near the mouths of tidal streams. Full-grown trees are from 15 to 40 centimeters in diameter and from 8 to 11 meters in height.

Key to the species.

Flowers few on an inflorescence, each with a short stalk; apex of petals with three to four club-shaped appendages.......................... *Ceriops tagal.*

Flowers few on an inflorescence, without individual stalks; apex of petals lacerate, that is with a torn appearance............... *Ceriops roxburghiana.*

CERIOPS TAGAL (Perr.) C. B. Rob. TAN͠GÁL.

Local names: *Tan͠gál* (Tagalog, Bisayan, Zambales, and Zamboanga); *tun͠gód* (Bisaya in Negros); *tan͠ghál* (Mindoro); *magton͠gód* (Mindoro);

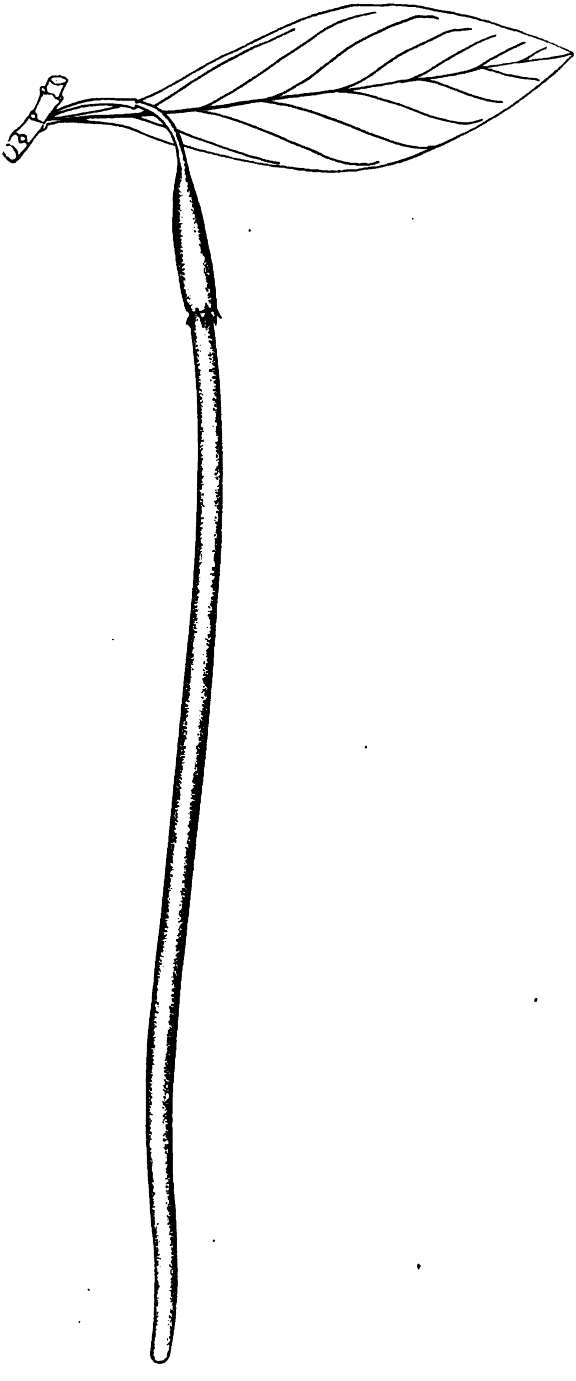

PLATE XXIV. FRUIT OF BRUGUIERA PARVIFLORA.

tañgál-lalaki (Mindoro); *tuñgúd* (Jolo); *toñgóg* (Masbate); *tagása* (Bataan); *pakat* (Palawan); *tonggui* (Culion); *tuñgóg* (Visayan); *róñgon* (Zambales); *rúñgon* (Pangasinan).

The leaves of *Ceriops tagal* are from 5.5 to 7 centimeters in length and from 2 to 4.5 centimeters in breadth; the petioles, from 2 to 3 centimeters in length. The flowers are about 6 millimeters long and are borne on short stalks. The calyx-lobes are oblong and somewhat blunt. The petals are oblong; the apex flat or notched and with three or more club-shaped appendages. Stamens ten, nearly as long as the petals.

Ceriops candollearia H. & A. is a synonym of *Ceriops tagal* (Perr.) C. B. Rob.

CERIOPS ROXBURGHIANA Arn. (Plates XXV, XXVI). TAÑGÁL.

Local names: *Matañgál* (Bataan); *tañgál* (Tayabas and Camarines); *tuñgung* (Surigao); *bakáuan* (Bataan and Mindoro); *bulubadiáng* (Panay); *tuñgúg* (Negros).

Ceriops roxburghiana has leaves up to 11 centimeters in length and 6 in breadth, petioles 1.5 to 3 centimeters in length. The flowers are about 5 millimeters long and about 5 millimeters broad and do not have individual stalks. The five or six calyx-lobes are short and somewhat pointed. The petals are oblong, white when young, turning to brown; the apex notched or slightly flattened and with a torn appearance.

Genus RHIZOPHORA

Bakáuan is the name given to the species of *Rhizophora*. These make up a very large part of the swamp and are often the most conspicuous constituent of it.

These trees are distinguished from all others by their much-branched prop roots, which hold the trees up out of the water. This is perhaps the reason why the wood of these trees is usually sounder than that of others from the swamp. Besides the roots which come out from the base of the trunk, there are often large numbers of roots developed from the lower branches. The bark is very dark, almost black, coarsely ridged, and about 2 centimeters thick. It contains a high percentage of tannin.

The sapwood is yellow or whitish; the heartwood dark orange to reddish brown. The transition from sapwood to heartwood may be either gradual or abrupt. The wood is hard and heavy. The sapwood is 3 to 5 centimeters thick, and in old trees very sharply distinguished from the dark heartwood. The grain is straight and the texture fine and dense. It has a conspicuous

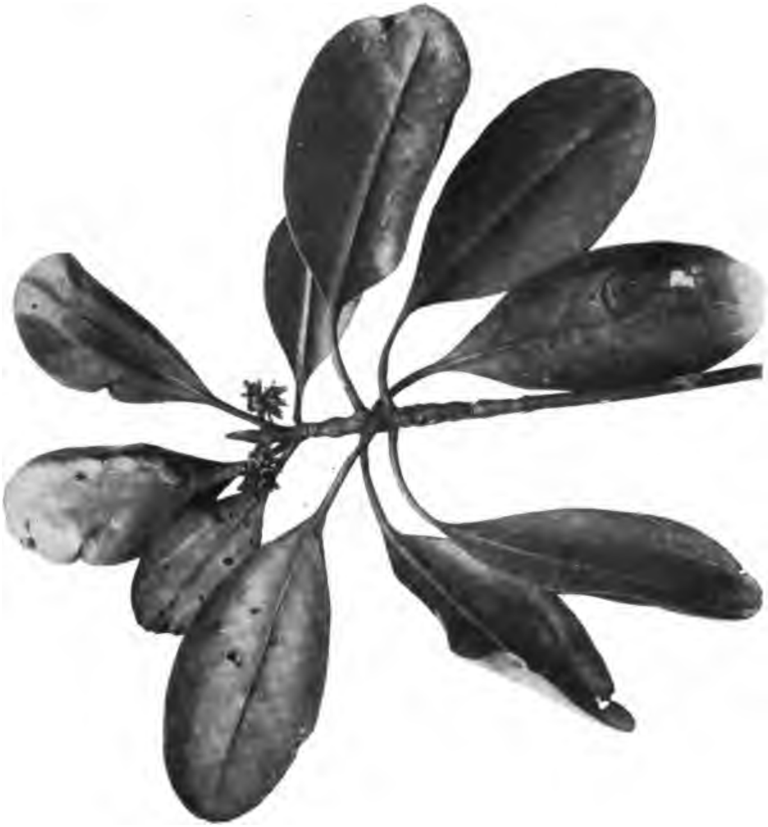

PLATE XXV. CERIOPS ROXBURGHIANA WITH FLOWERS.

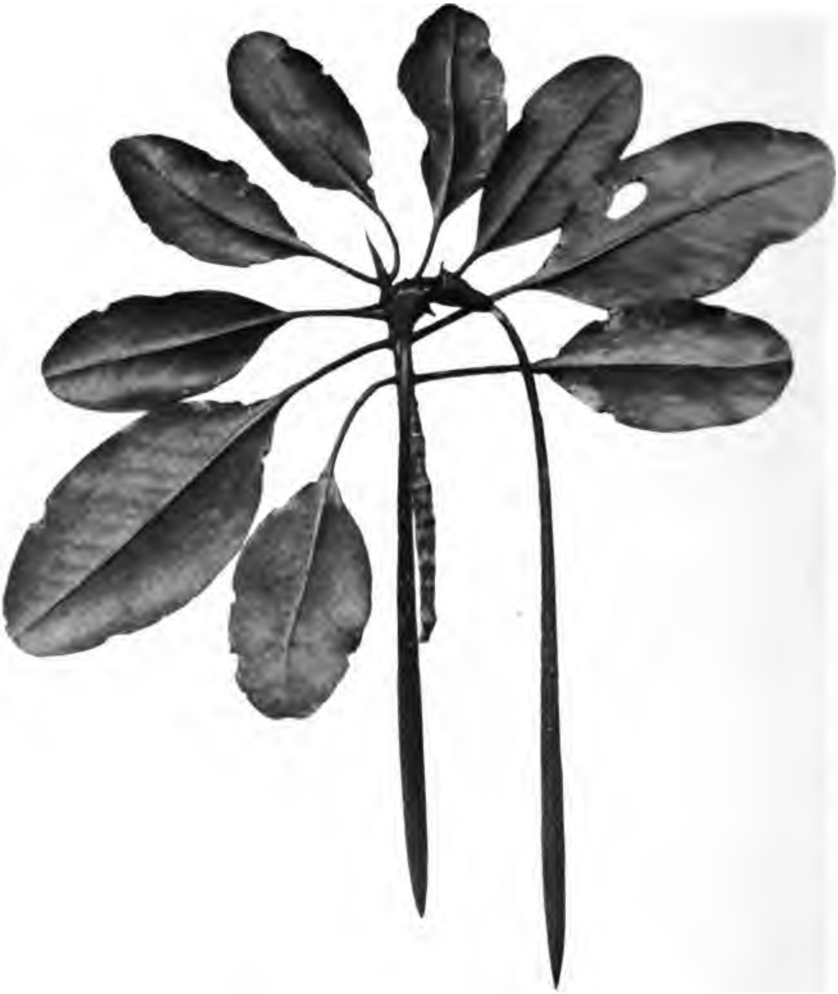

PLATE XXVI. CERIOPS ROXBURGHIANA WITH FRUITS.

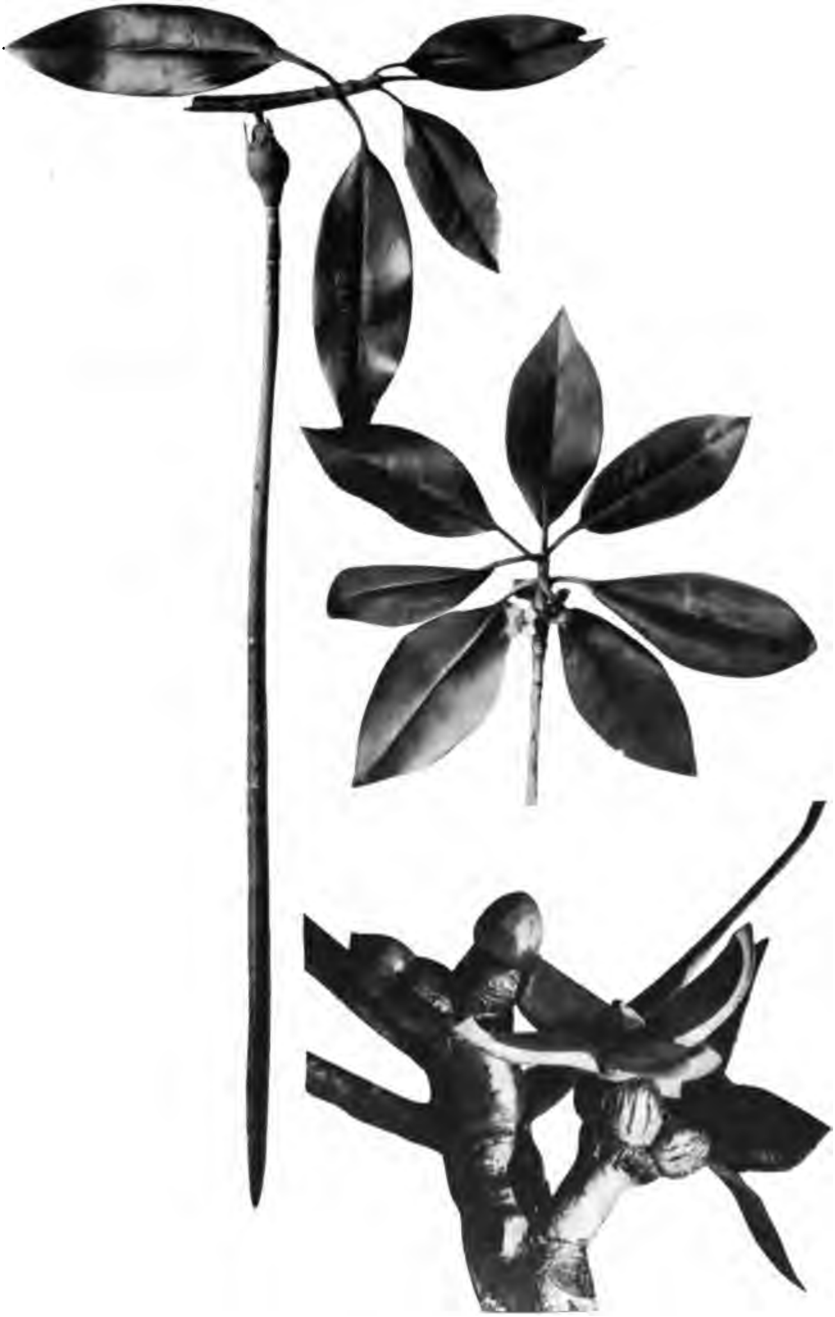

PLATE XXVII. RHIZOPHORA CANDELARIA, FRUIT AND OLD FLOWERS FROM WHICH PETALS HAVE FALLEN.

silver grain. Logs and large timbers are liable to check badly; but, if the wood is properly sawn and carefully stacked, it seasons with little warping and splitting. It is hard to saw, but not otherwise difficult to work. It lasts well in wet situations and is rarely attacked by insects.

The wood is used for salt water and foundation piling, mine timbers, house posts, furniture, and cabinet-work; if properly sawn and carefully seasoned, it would make an excellent flooring. On account of its shape, great strength, and durability when submerged in fresh water, it is specially recommended for submerged foundation piles.

The pear-shaped fruit is brown, with a granular or roughened surface. The seedling is long, spindle-shaped, and green. It grows downward and out of the fruit before the latter falls from the tree. The surface of the seedling is very smooth, except for occasional dark brown lenticels which project from the surface. The seedling grows to a length of 75 to 100 centimeters before dropping into the mud, where it promptly takes root. The maximum diameter attained by bakáuan is about 60 centimeters; exceptional trees sometimes have a clear length of 25 meters. The average dimensions are, however, much smaller than the figures just given. Where there is an abundance of light, the bole is usually crooked, low branched, and practically worthless except for firewood. In the interior of the forest bakáuan is fairly straight, round boled, and has a moderately spreading crown.

The calyx is four-lobed. The petals are four in number, and slightly shorter than the calyx-lobes.

The two species of *Rhizophora* are easily distinguished, either in flower or fruit. The inflorescence stalks of *Rhizophora candelaria* are very short, being shorter than the petioles, occur below the leaves, and each bears two flowers. The inflorescence stalks of *Rhizophora mucronata* are among the leaves, as long as the petioles, and each bears from three to seven flowers. The fruits of the two species are easily separated by the length of the stalks. All of these characters are shown plainly in the illustrations of the species.

Key to the species.

Flowers below the leaves; inflorescences with two flowers; stalks of inflorescences shorter than the petioles........................ *Rhizophora candelaria.*

Flowers among the leaves; inflorescences with three to seven flowers; stalk of inflorescences as long as the petioles.................... *Rhizophora mucronata.*

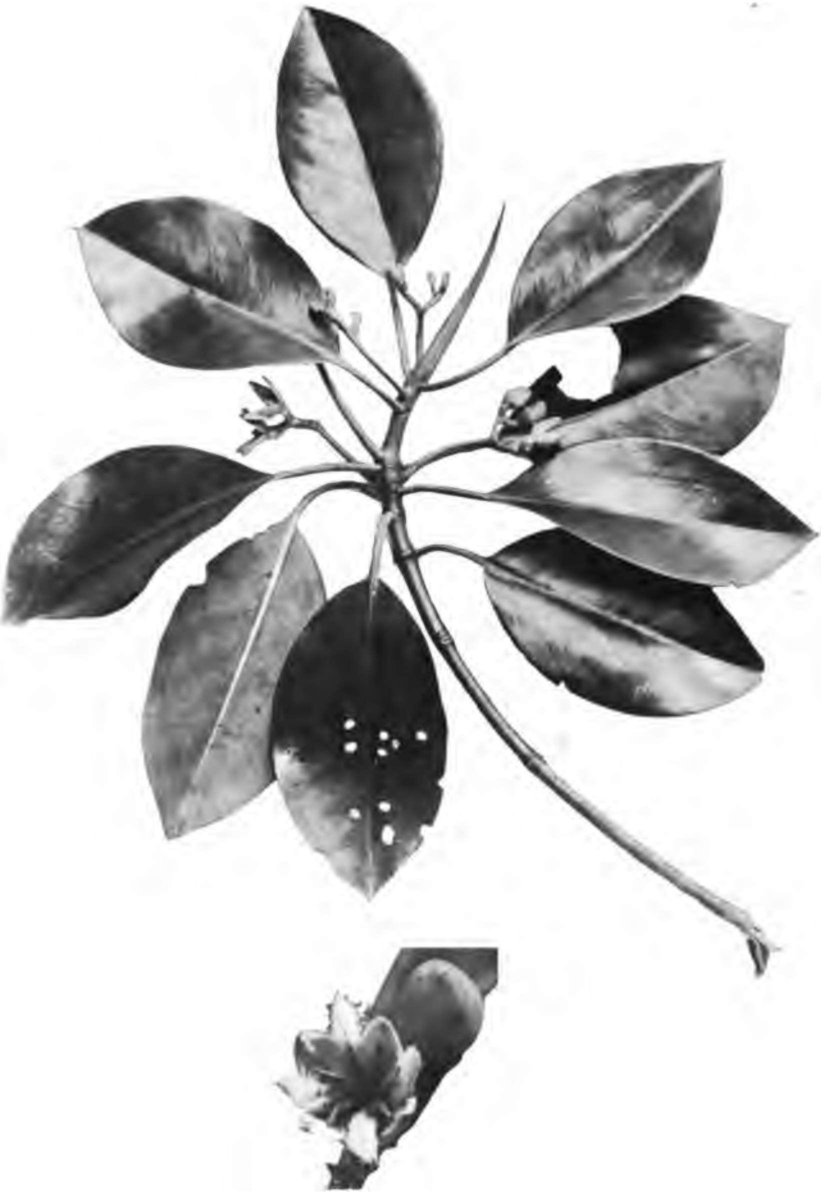

PLATE XXVIII. RHIZOPHORA MUCRONATA, INFLORESCENCES AND FLOWER.

RHIZOPHORA CANDELARIA DC. (Plates I, XXVII). BAKÁUAN-LALÁKI.

Local names: *Bakáuan* (Tagalog); *bakáu* (Visayan); *bakáuan-babáe* (Tagalog and Bisaya, Zamboanga); *uakátan* (Mindoro); *bakáuan-laláki* (Mindanao); *bakad* (Zambales); *bakhau* (Samar, Capiz); *bakau-laláki* (Pampanga); *bangkáu* (Davao).

The leaves of *Rhizophora candelaria* are 10 to 16 centimeters in length, leathery in texture, green and shiny, and oblong-elliptic in shape. The apex is pointed or ends in a thornlike prolongation of the midrib. The stalks of inflorescences are found in the axils of fallen leaves and are shorter than the petioles of the leaves. Two flowers are borne on each inflorescence stalk. The flowers are pale greenish yellow.

This species is usually known by the erroneous name *Rhizophora conjugata*.

RHIZOPHORA MUCRONATA Lam. (Plates XXVIII, XXIX). BAKÁUAN-BABÁE.

Local names: *Bakáuan* (Tagalog); *bakhao* (Surigao); *bakáu* (Negros); *bakáuan-laláki* (Zambales); *bakáuang-laláki* (Zamboanga); *bangkáu* (Tagalog in Tayabas).

The leaves of *Rhizophora mucronata* are leathery in texture, oblong-elliptic, shiny, and up to 16 centimeters in length. The apex of the leaf terminates in a slender, thornlike prolongation of the midrib. The inflorescence stalks are among the leaves. They are from 2.5 to 4 centimeters in length, about as long as the petioles of the leaves, forked at the apex, and bear from three to seven flowers. The flowers are white to cream color.

Family 10, COMBRETACEAE

Genus LUMNITZERA

Key to the species.

Flowers scarlet .... *Lumnitzera littorea.*
Flowers white .... *Lumnitzera racemosa.*

LUMNITZERA LITTOREA Voigt. (Plate XXX). TABÁU.

Local names: *Batíng* or *baktíng* (Tawi-tawi, Jolo); dalúru-babáe (*Tayabas*); *sagása'* (Dinagat Island); *maóro* (Surigao); *kolasíman* (Culion Island); *libáto* (Tayabas, Polillo, Palawan); *panting-pantíng* (Basilan); *kalapíni'* (Zambales); *kulási* (Mindoro); *bulokbúlok* (Negros Occidental); *agnáia* (Zambales); *karifurug* (Cagayan); *anilái* (Mindoro); *papásil* (Tayabas); *magalolo* (Polillo); *santíng* (Moro and Tawi-tawi); *tabáu* (Capiz, Negros, Zamboanga, Sorsogon, Masbate); *dulokdúlok* (Masbate); *sala'sá* (Occidental Negros).

This species is a tall tree found along rivers in the swamps,

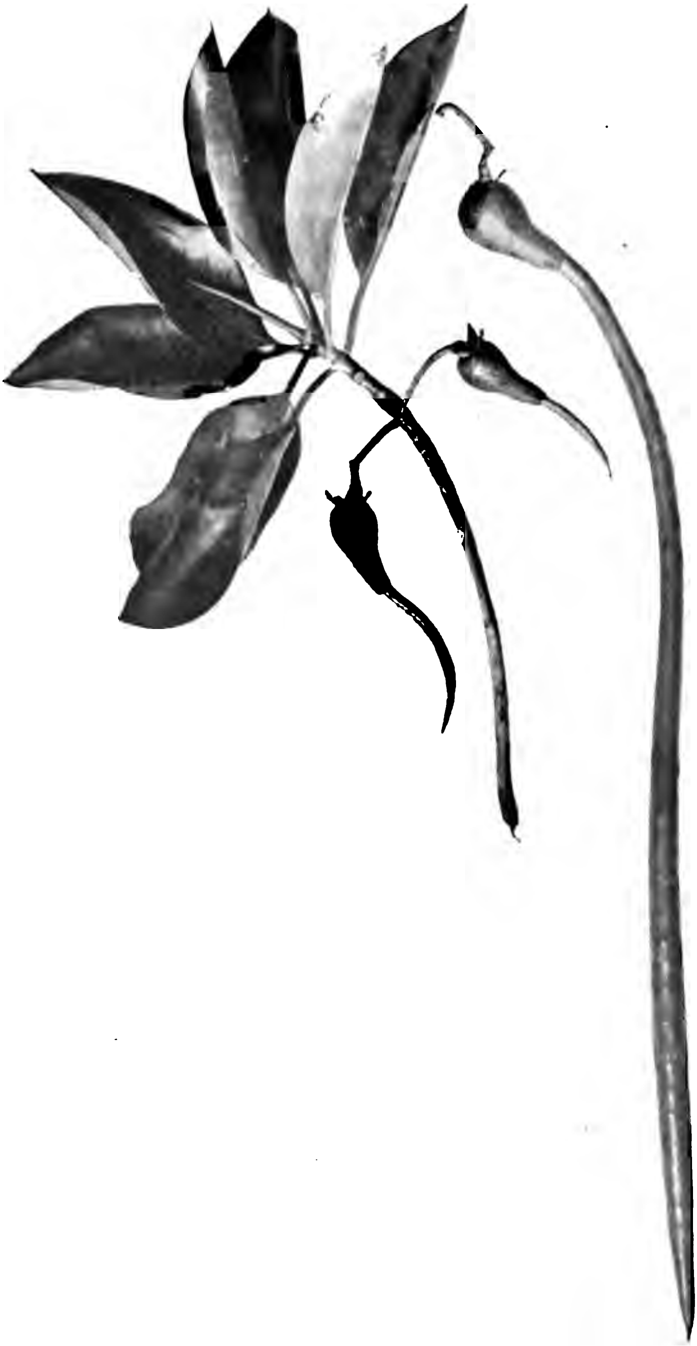

PLATE XXIX. RHIZOPHORA MUCRONATA WITH FRUIT.

and a smaller tree or shrub where conditions for growth are less favorable. It reaches a diameter of 50 centimeters and a height of 18 meters. The bark is gray when the tree is young and often nearly black when mature, coarsely furrowed, rather thick and corky. The air roots are few in number and similar to those of *Bruguiera conjugata*, *B. sexangula*, and *B. cylindrica*.

The wood has a distinct roselike odor when fresh. The sapwood and heartwood are not very different in color; the wood is pale brown, straight grained, dense and smooth, with a fine texture, and takes a silky finish under a sharp plane. It seasons well and is easy to work. It is used for piles, poles, house posts, ties, paving blocks, bridges, and wharves, general strong construction, ship planking and decks, handles, and cabinet-work.

The leaves are 5 to 8 centimeters long, alternate, very thick and fleshy, rounded at the apex and notched, and clustered toward the ends of the twigs. The petioles are very short. The flowers are bright scarlet and about 8 millimeters in length. They are borne in considerable numbers at the ends of branches. The calyx tubes terminate in five lobes. The petals are scarlet, five in number, and about 7 millimeters long. There are five to ten, but usually seven stamens, which are the same color and twice as long as the petals. The fruit is woody, elongated, about 2 centimeters long and 7 millimeters wide, narrowed at each end, crowned by a persistent calyx rim, and contains a single seed.

LUMNITZERA RACEMOSA Wild. KULÁSI’.

Local names: *Tabáu* (Iloilo, Tayabas); *sulási’* (Rizal, Manila); *kulási’* (Bataan).

This species differs from the last in being of much smaller size and in having white flowers. This tree grows in mud in the swamp or in sand at the edge of the swamp. The wood is like that of *Lumnitzera littorea.*

The leaves are fleshy, green, shiny, 2.5 to 7 centimeters in length, the apex rounded and notched, the base pointed, the petioles very short. The flowering shoots are borne in the axils of leaves and are from 2 to 6 centimeters long. The calyx is green, 5 to 6 millimeters long, with five short lobes. The petals are white, about 4 millimeters long, and five in number. The stamens are white, about as long as the petals, and five to ten in number. The fruit is woody, green, oblong, about 1.5 centimeters long, narrowed at both ends, crowned by the persistent calyx rim, and contains a single seed.

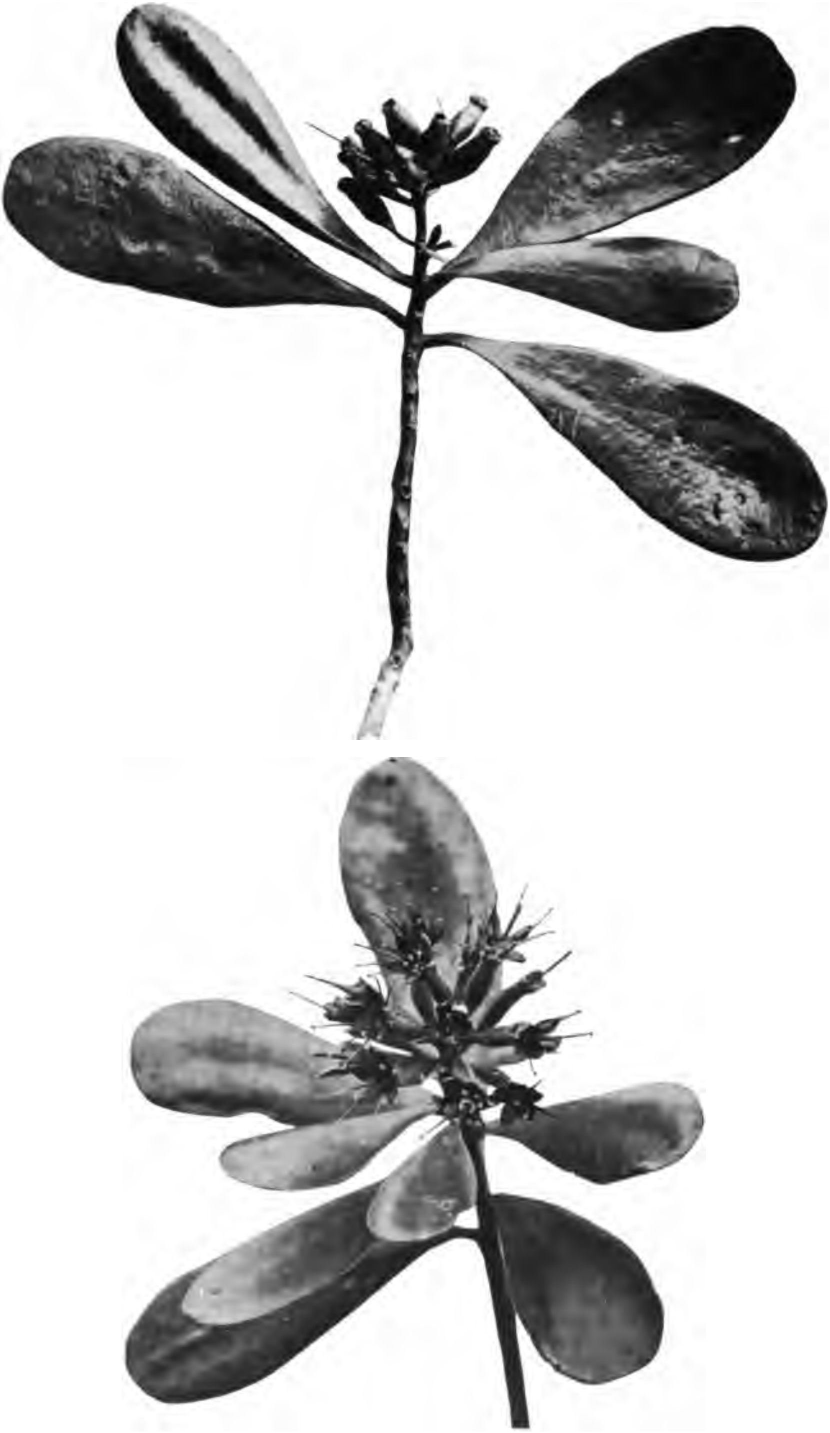

PLATE XXX. LUMNITZERA LITTOREA, FRUIT AND FLOWERS.

Family 11, MYRTACEAE

Genus OSBORNIA

OSBORNIA OCTODONTA F. Muell. (Plate XXXI). TAWALIS.

Local names: *Tuawis* (Palawan); *tiwayos* (Masbate); *gunhun* (Basilan); *maligáng* (Polillo Island); *tawalis* (Tayabas, Camarines); *sagasá'* (Iloilo); *tabáu* (Negros); *duluk-dúluk* and *sagasá'* (Negros); *monotbonot* (Leyte); *kulási'* (Zamboanga); *tuanio* (Tayabas).

Osbornia octodonta is a small tree with a very crooked trunk. The bark is reddish brown and very shaggy, and is sometimes used in the caulking of boats. The wood is light grayish brown, fine grained, and exceedingly durable.

All parts of the plant are smooth except the flowers, which are hairy. The leaves are opposite, rounded at the tip, pointed at the base, about 4 centimeters long, and 1 to 2 centimeters wide. The flowers are white, less than a centimeter in length, without stalks, and are borne either singly or in groups of a few flowers either in the axils of the leaves or at the ends of branches. Petals are lacking. The calyx is bell-shaped and terminates in eight lobes. The fruit is included within the calyx tube and contains one or two seeds.

Family 12, MYRSINACEAE

Genus AEGICERAS

Key to the species.

Leaves up to 4.5 centimeters wide; flowers in rounded clusters, all of the flower stalks joined at about the same point......... *Aegiceras corniculatum.*
Leaves 3 centimeters wide or less; flowers in compound inflorescences. *Aegiceras floridum.*

AEGICERAS CORNICULATUM (Linn.) Blanco. (Plates XXXII-XXXIV). SAGING-SÁGING.

Local names: *Timbambákis, pilápil, pagatpát, pipisík* (Bataan); *saging-ságing* (Capiz, Negros, Lanao, Surigao, Mindoro); *kindug-kindúg, sulasig, tinduk-tindúkan* (Tayabas); *dumanai* (Cagayan); *tindok-tindók* (Leyte, Tayabas); *tindók* (Mindoro); *tunduk-tundúkan* (Polillo Island); *batag-batág* (Zambales); *bulali* (Negros); *tayokón* (Surigao).

Aegiceras corniculatum is a small tree or shrub which is found along streams in the inner part of the swamp and, occasionally, on more or less sandy spots in the outer part of the swamp. The bark is dark brown. The tree rarely exceeds 8 meters in height and is usually much smaller.

The leaves are alternate, leathery, smooth, rounded and notched at the apex, somewhat pointed at the base, usually from 4 to 10 centimeters in length, and 2.5 to 6 centimeters wide; the

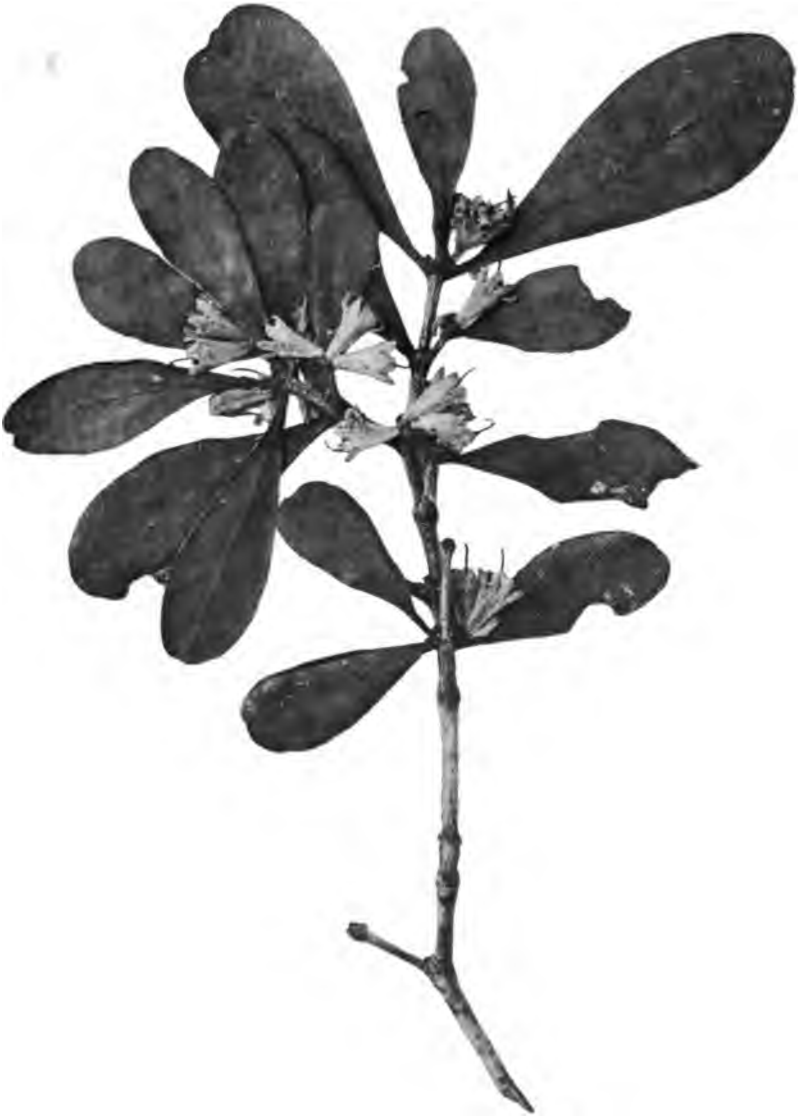

PLATE XXXI. OSBORNIA OCTODONTA WITH FRUITS.

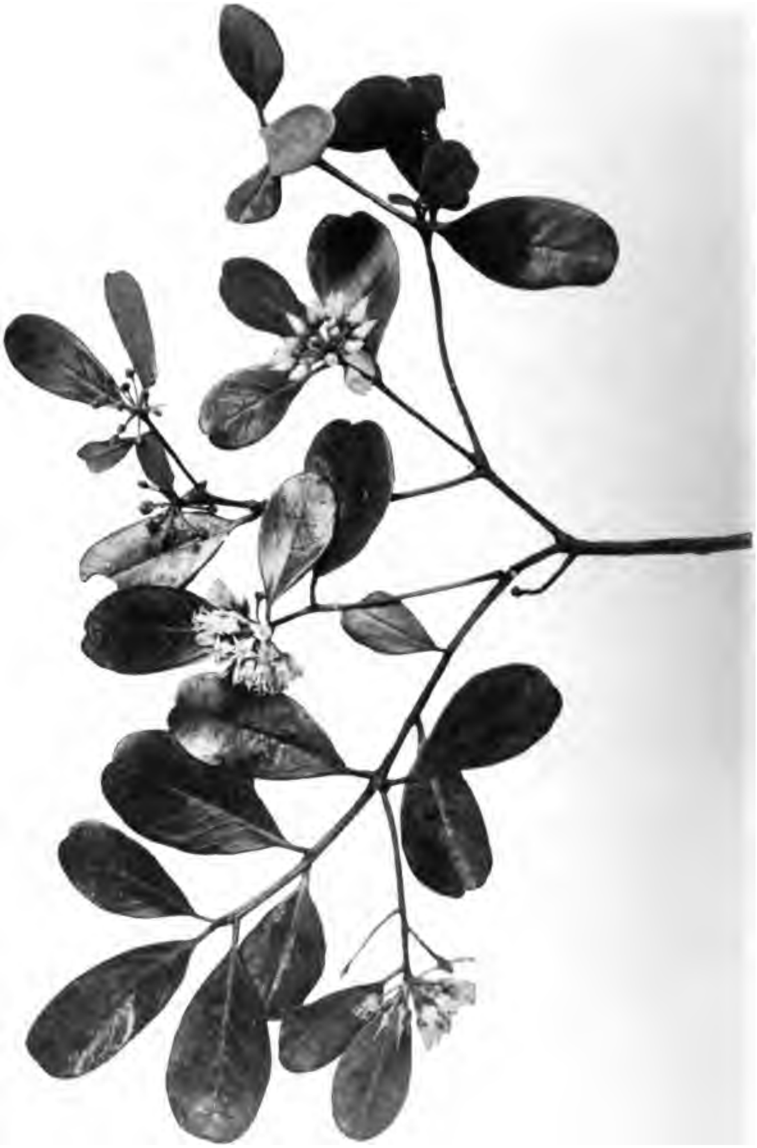

PLATE XXXII. AEGICERAS CORNICULATUM WITH FLOWERS.

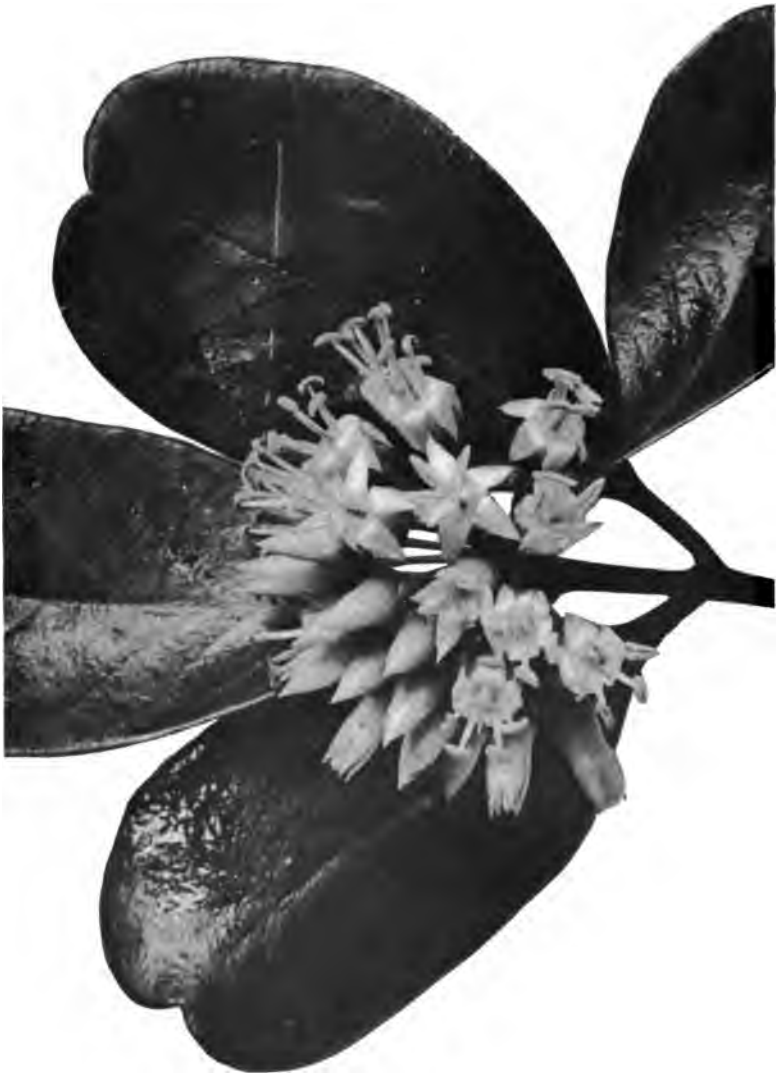

PLATE XXXIII. FLOWERS OF AEGICERAS CORNICULATUM.

midrib is slender; the petioles are usually about a centimeter or less in length. The flowers are fragrant and borne in rounded clusters, the bases of the stalks all rising from nearly the same point. The flower stalks are slender and 1 to 2 centimeters in length. The calyx has 5 lobes, which are leathery, twisted to the left and overlapping to the right, and about 6 millimeters long. The corolla is white and has a short tube about 6 millimeters long with five pointed lobes, which overlap to the right in the bud and are about as long as the tube. There are five stamens, which are inserted on the corolla tube and are longer than the corolla lobes. The fruit is shaped like a miniature banana except that it usually ends in a sharp point. It is up to 7 centimeters in length and contains a single, elongated seed which fills the cavity of the fruit.

AEGICERAS FLORIDUM R. and S. (Plate XXXV). TINDUKTINDUKAN.

This species is much less abundant than *Aegiceras corniculatum* and differs from it in having smaller leaves, which are 3 centimeters or less in width, and in having branched inflorescence stalks.

Family 13, APOCYNACEAE

Genus CERBERA

CERBERA MANGHAS Linn. (Plate XXXVI). BARAYBÁY.

Local names: *Buto-butó* (Surigao, Dinagat Island); *bayag-usá*, *pandakaki* (Camarines); *baraybáy* (Baler); *butá-butá* (Bataan), *bat-ano* (Camiguin Island); *kúbi* (Zambales); *ditá* (Moro); *lipáta* (Palawan); *panabulón* (Negros); *dun͠gás* (Cotabato).

Cerbera manghas is usually a shrub, although it may sometimes grow into a small tree. It occurs in situations similar to *Excoecaria agallocha*. *Cerbera manghas* has milky sap like that of *Excoecaria*.

The leaves are shiny, narrowed at both ends, and about 20 centimeters long. The flowers are white, fragrant, about 5 centimeters in diameter, and occur on terminal branches. The calyx tube is short and ends in five lobes, which are spreading, pale green, pointed, and about 2 centimeters long. The corolla tube is slender, greenish white, large above, and about 4 centimeters long. The upper part of the corolla is spreading, about 5 centimeters in diameter, white with a purple center, and divided into five lobes. The fruit is smooth, green, rounded, and about 6 centimeters long.

Cerbera odollam Gaertn. is a synonym of *Cerbera manghas* Linn.

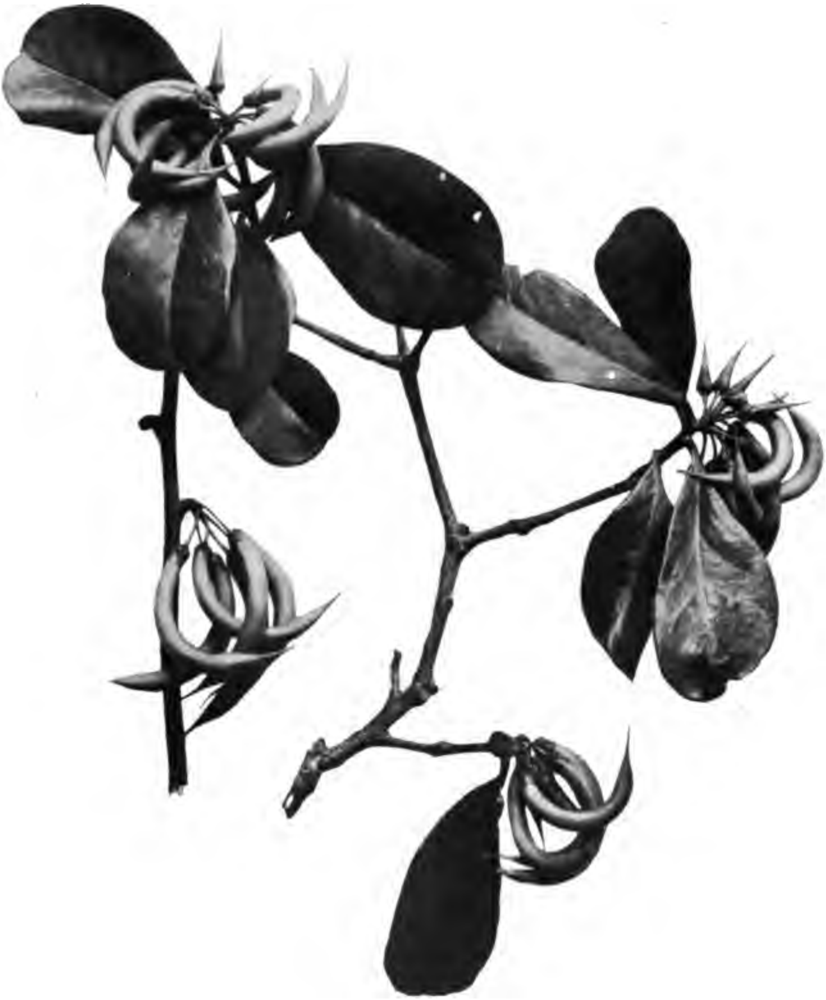

PLATE XXXIV. AEGICERAS CORNICULATUM WITH FRUITS.

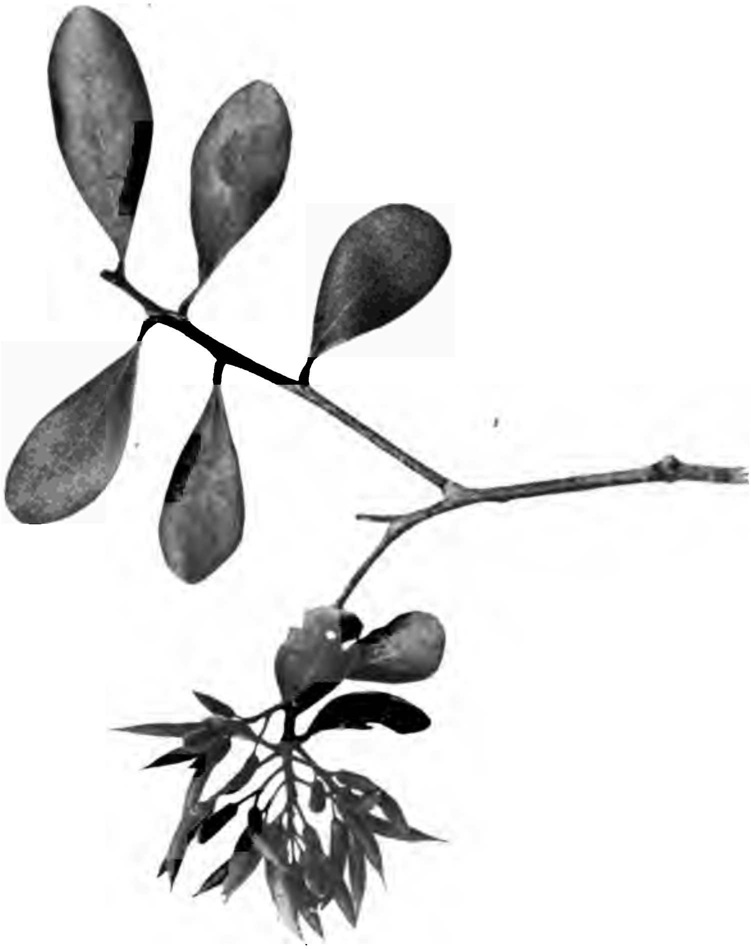

PLATE XXXV. AEGICERAS FLORIDUM WITH IMMATURE FRUITS.

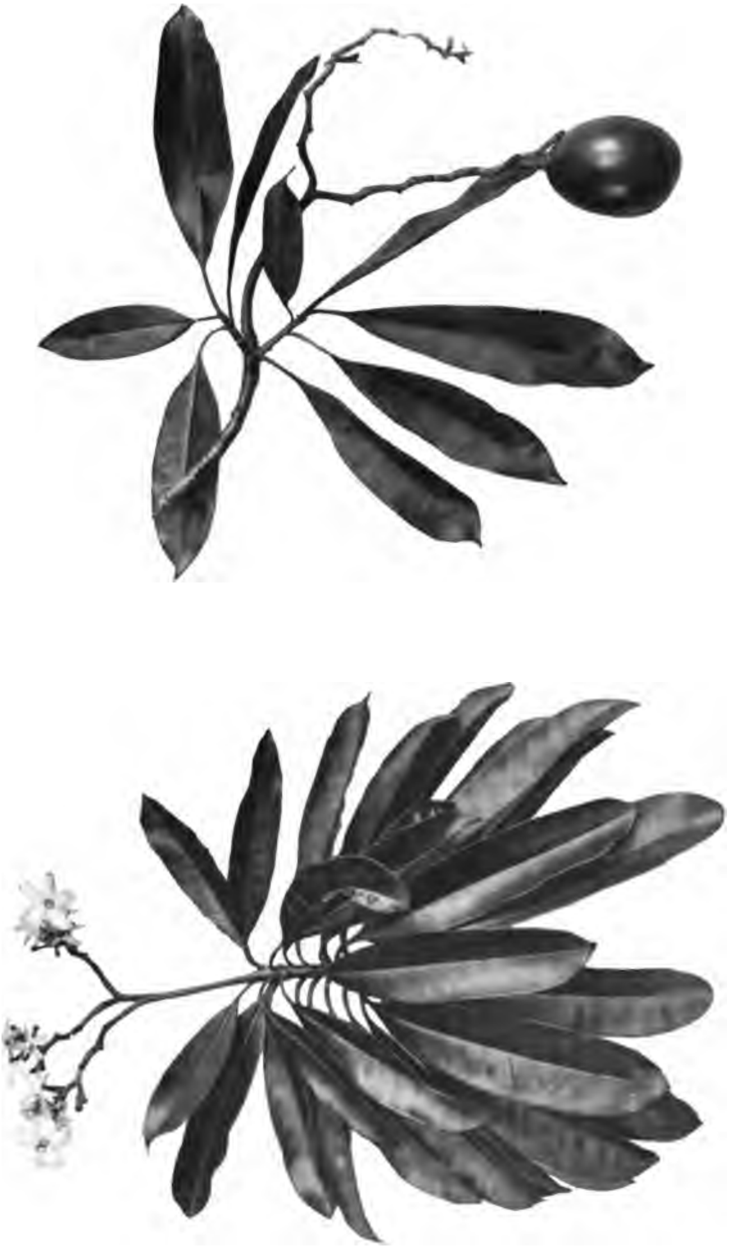

PLATE XXXVI. CERBERA MANGHAS, FLOWERS AND FRUIT.

Family 14, VERBENACEAE

Genus AVICENNIA

Trees of *Avicennia* are distinguished from all others in the swamps by the lower surface of the leaves being light gray or white. This character is most nearly approched in *Heritiera*, the lower surfaces of the leaves of which have a silvery appearance.

Key to the species.

Tips of leaves usually somewhat rounded.................. *Avicennia officinalis.*
Tips of leaves pointed.. *Avicennia alba.*

AVICENNIA OFFICINALIS Linn. (Plates XXXVII, XXXVIII). API-ÁPI.

Local names: *Miápi* (Samar, Leyte, Masbate); *api-ápi* (Capiz, Bataan, Davao, Zamboanga, Cotabato, Palawan, Mindoro); *kalapiní mangit-it* (Zambales); *buñgálon* (Marinduque, Tayabas, Pangasinan, Zambales, Mindoro, Capiz, Iloilo, Camarines, and Negros); *kulási* (Cotabato); *kalapíni'* (Pangasinan, Bataan, and Zambales); *pipisíg* or *pipisík* (Tayabas, Camarines, Mindoro); *piápi* (Iloilo, Capiz, Agusan, Tayabas); *liñgóg* (Cagayan); *piksík* (Mindoro).

This species is a tree of the outer part of the swamp. The bark is usually light gray or brown and rather smooth but finely checked by small cracks. The air roots are numerous, small, 8 to 20 centimeters high, and conical. This species is of little value. In swamps where cutting has been excessive, and more valuable species removed, the latter are often largely replaced by *Avicennia officinalis.*

The wood is hard, heavy, brittle, but difficult to split, having an exceedingly crossed spiral grain. The sapwood is 4 to 6 centimeters thick, whitish, turning in drying to gray or light brown, in large trees sharply marked off from heartwood. The heartwood is purplish gray. The grain is very conspicuous from alternate bands of hard and soft tissue, very strongly crossed, often irregularly wavy. The texture of the hard tissue is extremely fine and dense; of the soft tissue, somewhat coarser. The wood seasons well, but the sapwood is liable to stain badly if not seasoned quickly. It is not difficult to work. The durability is said to be poor, but the wood is rarely attacked by beetles. It is used locally for rice mortars; is a favorite in some regions for smoking fish; a wood that for its peculiar color and attractive grain should find a good place in small cabinetwork; recommended for trial in creosoted paving blocks.

The leaves are leathery, opposite, dark green above, very pale and hairy beneath, usually somewhat rounded at the apex, narrow at the base, 5 to 10 centimeters long and 2.5 to 5 centimeters broad; midrib stout and very prominent. The flowers

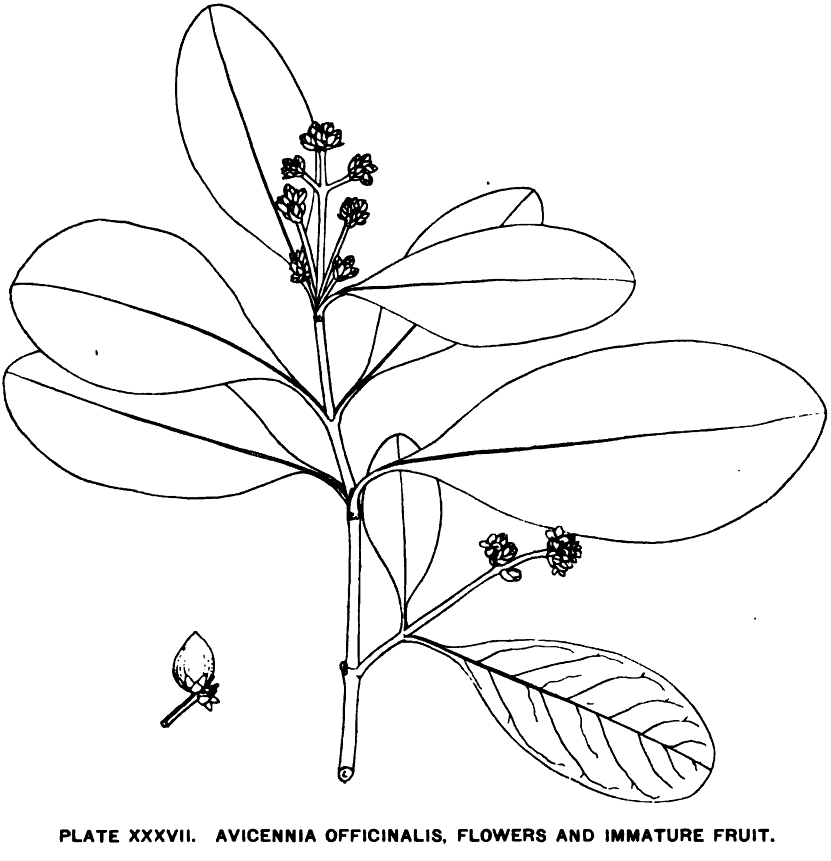

PLATE XXXVII. AVICENNIA OFFICINALIS, FLOWERS AND IMMATURE FRUIT.

are small, without individual stalks, and are in small heads on stiff angular flowering stalks, which occur either two together in the axils of the upper leaves or several at the end of a branch. There are three to seven flowers in each head. The corolla is orange-yellow. The corolla tube is very short, cylindrical, and has four lobes. The lobes are 5 millimeters in length, hairy without, and nearly smooth within. The calyx has five lobes, which are 2 to 8 millimeters long, hairy on the margins; the lower part of the back hairy, the rest smooth. There are four stamens, which are inserted on the throat of the corolla and extend beyond the corolla. The fruit is a capsule, 2.5 to 4 centimeters long, and contains a single seed which completely fills the capsule.

AVICENNIA ALBA Blume. API-ÁPI.

Local names: *Kachúchis* (Surigao); *piápi* (Misamis); *pundúng* (Cotabato)

This species is apparently less abundant than *Avicennia officinalis* and differs from it largely in inconspicuous floral characters. The wood appears to be identical with that of *Avicennia officinalis.*

The leaves are leathery, pointed at the apex, narrowed at the base, either smooth on both surfaces or with whitish hairs beneath, especially when young; 5 to 7 centimeters long, 2.5 to 5 centimeters broad. The midrib is prominent. The flowers, without individual stalks, grow either in small heads or in spikes. The calyx has segments, which are thick, 2.5 millimeters long, fringed with hair, and slightly hairy at the back near the base. The corolla tube is very short and sometimes almost lacking. It has four smooth pointed lobes, 2.5 millimeters long. There are four stamens inserted on the corolla throat. These do not reach to the end of the corolla. The fruit is a capsule 1 to 2 centimeters in length and contains one seed which completely fills the lower part of the capsule.

Family 15, ACANTHACEAE

Genus ACANTHUS

Key to the species.

Flowers blue; corolla about 4 centimeters long................	*Acanthus ilicifolius.*
Flowers white; corolla about 2 centimeters long..........	*Acanthus ebracteatus.*

ACANTHUS ILICIFOLIUS Linn. (Plate XXXIX). DILIUÁRIU.

Local names: *Lagoilói* (Agusan); *gregorio* (Bisaya); *dagudri, galura, tindoi, tinlui* (Tagalog); *daluári* (Bataan); *santing-santing* (Moro); *duluáriu* (Mindoro).

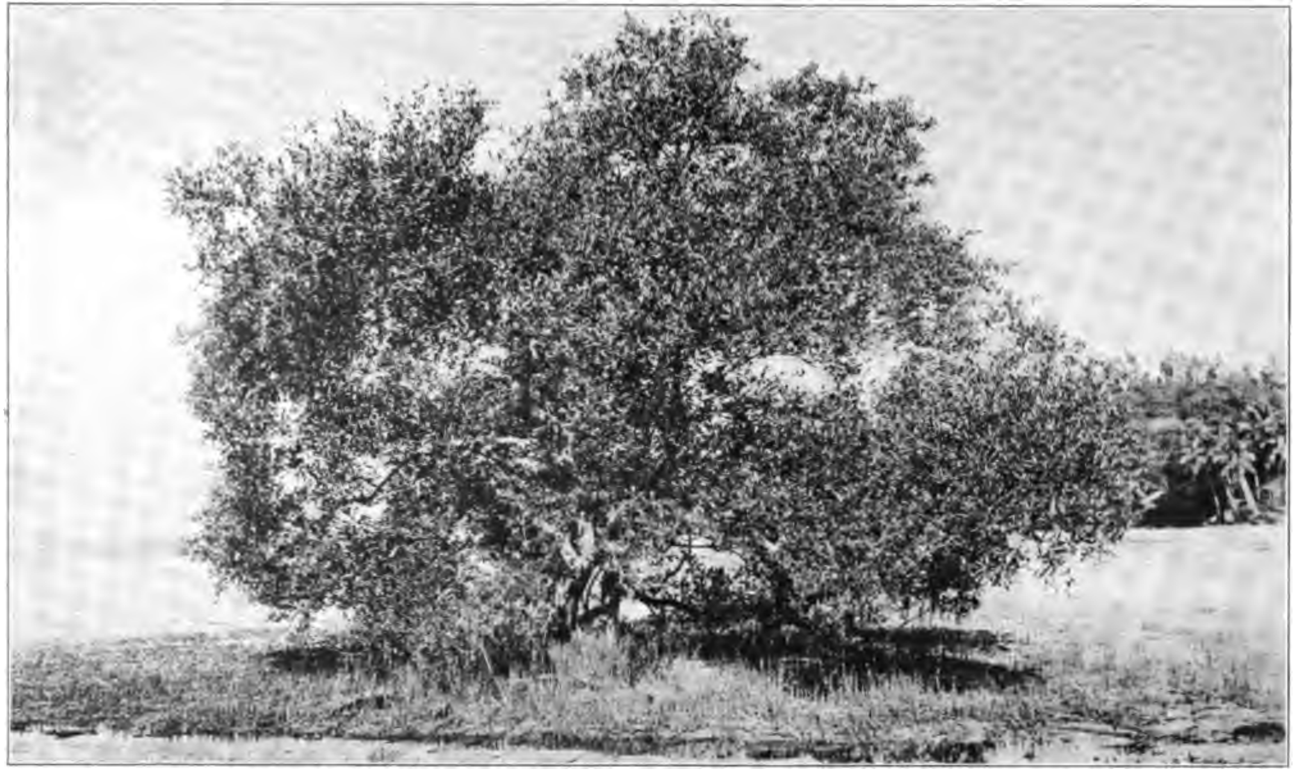

PLATE XXXVIII. AVICENNIA OFFICINALIS WITH AIR ROOTS.

Acanthus ilicifolius is a shrub 0.5 to 1.5 meters high. It has prop roots. The leaves are opposite and up to 18 centimeters in length and 8 in breadth. They have very short petioles. The flowers are about 4 centimeters long, borne on spikes, and are surrounded by two bracts and a bracteole. The calyx is divided near the base into four parts, two of which are much longer than the other two. The fruit is a capsule from 2 to 2.5 centimeters long.

ACANTHUS EBRACTEATUS Vahl. TIGBAU.

This species is also known by the same names as *Acanthus ilicifolius*. The flowers of *Acanthus ebracteatus* are surrounded by two bracts but no bracteole. The corolla is white and about 2 centimeters long. The calyx is shorter than in *Acanthus ilicifolius*. Otherwise the species is similar to *Acanthus ilicifolius*.

Family 16, RUBIACEAE

Genus SCYPHIPHORA

SCYPHIPHORA HYDROPHYLLACEA Gaertn. (Plate XL). NÍLAD.

Local names: *Arinaya* (Ilocos Norte); *landíng* (Culion, Tayabas); *tugisak* (Cotabato); *balasiái* (Zambales); *kulási'* (Tayabas); *hanbulali*, *tabáu* (Negros); *sagasá* (Zamboanga); *nílad* or *nílar* (Tagalog).

Scyphiphora hydrophyllacea is a small tree growing along streams in the swamps. It has dark-colored bark. All parts of the plant except the inside of the corolla tube are without hairs.

The leaf blades are smooth, leathery, rounded at the apex, and pointed at the base, 4 to 10 centimeters long, and 2 to 5 centimeters wide. The petioles are usually 1 to 2 centimeters long. The flowers are small, white, often tinged with red, and borne in compact groups. The calyx is about 4 millimeters long. The calyx tube ends in four or five small teeth. The corolla tube is cylindrical, about as long as the calyx with four or five lobes which are about half as long as the tube. The fruit is somewhat cylindrical, with eight to ten grooves, and usually a little less than a centimeter in length.

Family 17, COMPOSITAE

Genus PLUCHEA

PLUCHEA INDICA Linn. KALAPÍNI'.

Local names: *Banig-baníg* (Moro); *kalapíni'* (Manila); *manzanilla* (Batangas); *lagúndi'-láte* (Zambales).

Pluchea indica is a small shrub 1 to 4 meters in height. The leaves are 1 to 7 centimeters long and widest toward the tip, which is slightly pointed; the base narrows to a point; the margin

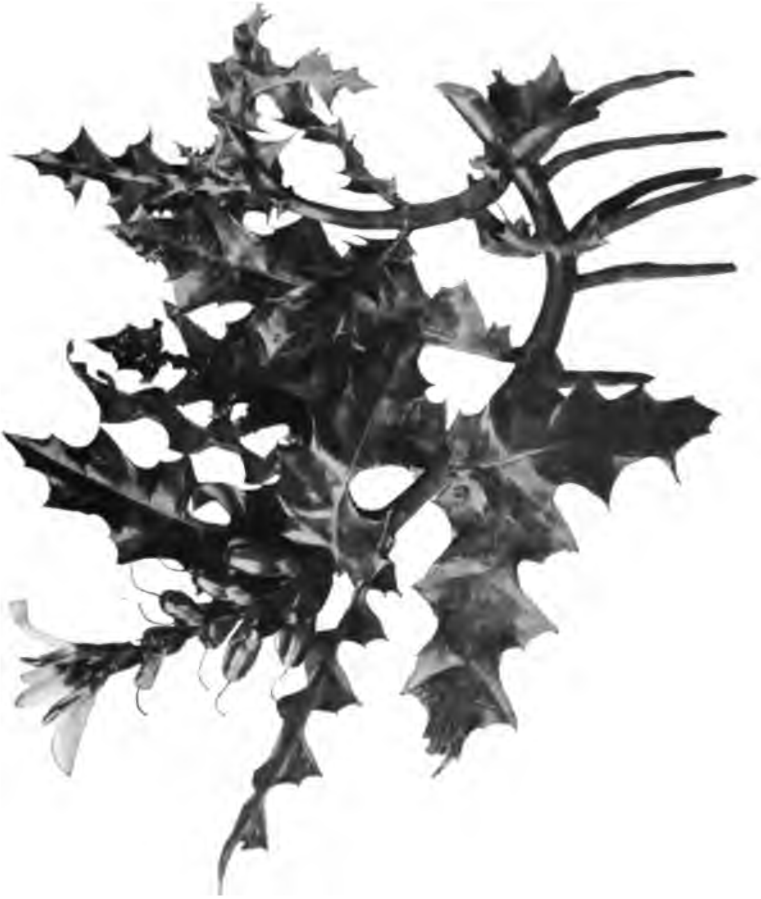

PLATE XXXIX. ACANTHUS ILICIFOLIUS, FLOWERS AND FRUIT.

is toothed. The flowers are light blue and are in dense heads arranged in compact inflorescences at the ends of branches. The fruit is minute and crowned with white hairlike projections.

STANDS IN MANGROVE SWAMPS

The present condition of the mangrove swamps in the Philippines is very variable. In places close to centers of population, as in the immediate vicinity of Manila, Iloilo, and Cebu, the swamps have been so closely cut-over as to make them almost valueless. In many other places the most valuable trees have been largely removed, in other areas the swamps yield a large quantity of good material, and still others are practically untouched. The largest remaining virgin swamps in the Islands are probably in Palawan and Mindanao, although in both of these islands a considerable amount of cutting and bark collecting has been carried on.

A careful study of the swamps near Port Banga, Mindanao, has been made by Dr. H. N. Whitford and Forester W. I. Hutchinson. The following extracts from their report describes this forest:

> The mangle forests of the Port Banga tract cover an area of 2,463 hectares (6,086 acres). The largest continuous body of swamp, varying in width from 0.5 to 2 kilometers (0.31 to 1.42 miles), extends from the head of Balon Bay northward to the Baluan River. Scattered areas, some of considerable extent, also occur near the Tungauan River, and in Ticbucay Bay and Port Banga.
>
> Light cuttings have been made in these swamps for many years, and since 1902 certain situations have been heavily culled for posts and poles. Tanbark has also been extensively exploited, many areas being practically stripped of Tangal, the species from which the bark is obtained.
>
> The mangle forest is made up of a dense stand of small and medium-sized trees, many of which are raised on stilt roots from 1 to 3 meters (3 to 10 feet) above the ground. The characteristic species of the stand are Pagatpat, Bakauan, and Pototan. In certain localities Piagau and Langarai form pure stands, to the practical exclusion of all other trees. Tangal and several minor species occur scattered throughout all the swamps.
>
> The soil is soft, black mud of unknown depth. Underbrush and litter are entirely absent. The only method of travel through many of the swamps is by climbing along on the stilt roots of the trees.
>
> In the area surveyed, Pagatpat and Bacauan formed over 90 per cent of the stand. The average diameter of all trees over 40 cm. (16 inches) is 47 cm. (18 inches). The largest tree is Pagatpat, which reaches a maximum diameter of 80 centimeters (31 inches) or more, with a maximum clear length of 17.50 meters (57 feet). The clear length of Bakauan almost equals Pagatpat, and that of Pototan exceeds it, but the greater percentage of these species falls below 40 centimeters (16 inches) in diameter.

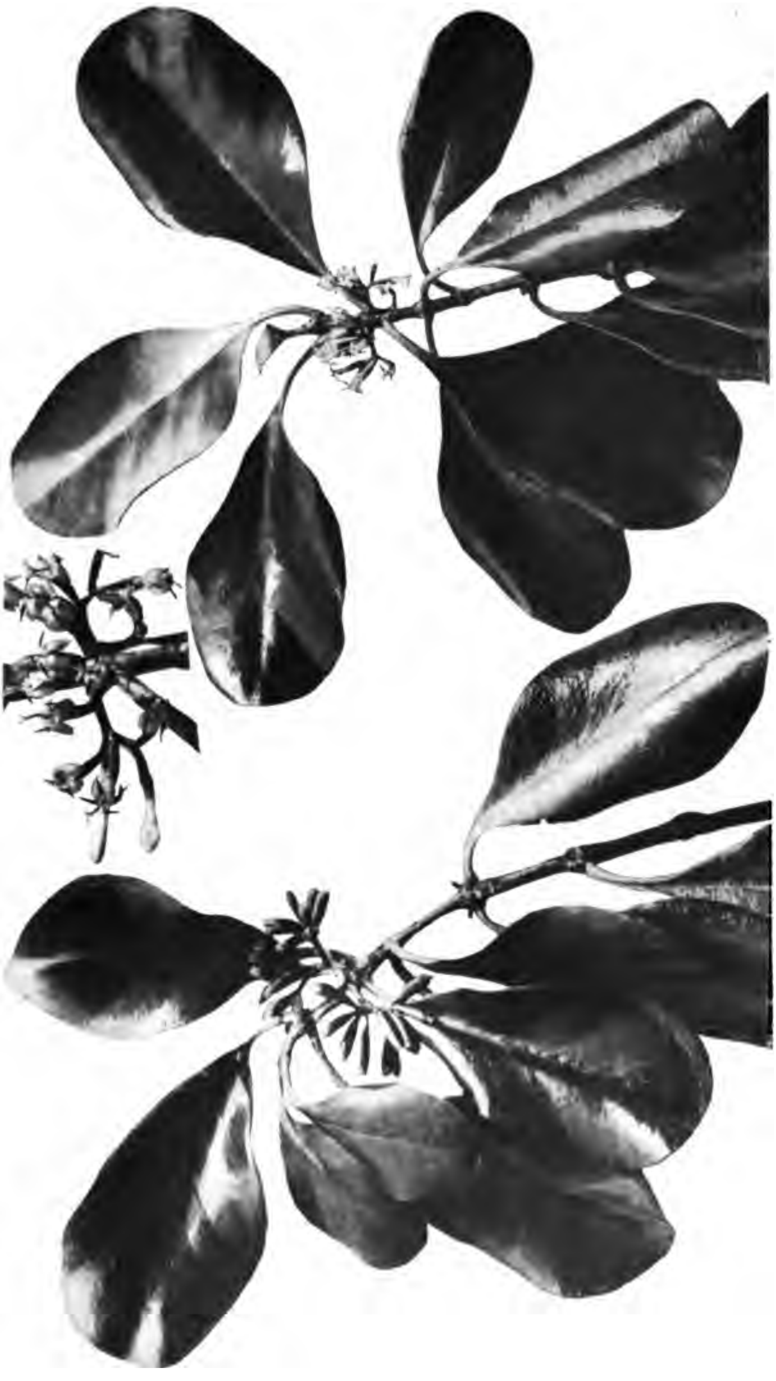

PLATE XL. SCYPHIPHORA HYDROPHYLLACEA, FRUITS AND FLOWERS.

Where the stand is dense, the trees are tall, straight, and clean-boled. In open situations, they are low-branched and crooked. Bakauan is the only important swamp tree with stilt roots.

TABLE I.—*Stand table for 1 hectare of mangrove swamp forest near Port Banga, Mindanao. Average of 6.25 hectares.*

[Data from H. N. Whitford and W. I. Hutchinson.]

AVERAGE NUMBER OF TREES 30 CENTIMETERS AND OVER IN DIAMETER.

Diameter at breast high or above buttresses.	Bakauan.	Pagatpat.	Tangal.	Pototan.	Total.	Other species.	Grand total.
cm.							
30	72.96	8.00	6.08	0.80	87.84	1.12	88.96
40	22.24	10.88	2.24	0.48	35.84	0.64	36.48
50	3.04	7.84	0.32	0.16	11.36	0.32	11.68
60	0.32	5.44	0.32	0.32	6.40		6.40
70		2.56			2.56		2.56
80		2.08			2.08		2.08
90		0.48			0.48		0.48
100		0.32			0.32		0.32
Total	98.56	37.60	8.96	1.76	146.88	2.08	148.96
Per cent	66.17	25.24	6.01	1.18	98.60	1.40	100.00

AVERAGE NUMBER OF TREES 40 CENTIMETERS AND OVER IN DIAMETER.

	Bakauan.	Pagatpat.	Tangal.	Pototan.	Total.	Other species.	Grand total.
Per hectare	25.60	29.60	2.88	0.96	59.04	0.96	60
Per cent	42.67	49.32	4.80	1.60	98.40	1.60	100

AVERAGE AND MAXIMUM DIAMETER OF COMMERCIAL TREES.

Species.	Average diameter breast high or above buttresses.		Maximum diameter breast high or above buttresses.	Number of trees measured.
	Trees 30 centimeters and over.	Trees 40 centimeters and over.		
	cm.	*cm.*	*cm.*	
Bakauan	32.97	41.44	60	616
Pagatpat	48.26	53.19	100	235
Pototan	40.00	48.33	60	11
Tangal	34.28	43.33	60	56
Average	38.88	46.57		

Table I shows the number of trees over 30 centimeters in diameter according to species and diameter classes of 10 centimeters. In Table II are shown the number of poles 6 to 15 centimeters and 16 to 25 centimeters in diameter. These figures were obtained in a virgin stand.

TABLE II.—*Stand of poles on one hectare in mangrove swamp forest, Port Banga area, Mindanao. Average of 6.25 hectares.*

[Data from H. N. Whitford and W. I. Hutchinson.]

Pole class.	Average number of poles per hectare.								
	Bakauan.	Tangal.	Pagatpat.	Pototan.	Total.	Miscellaneous species.	Grand total.	Per cent.	Average stand per acre.
Small, 6 to 15 cm. diameter	57.75	7.52	5.44	0.64	71.35	1.92	73.27	43.5	29.65
Large, 16 to 25 cm. diameter	74.88	11.04	7.04	1.12	94.08	1.12	95.20	56.5	38.53
Total	132.63	18.56	12.48	1.76	165.43	3.04	168.47	100.0	68.18
Per cent	78.73	11.02	7.41	1.04	98.20	1.80	100.00		

Dr. F. W. Foxworthy has found stands of from 300 to 650 cubic meters per hectare in large swamps in Mindanao.

Tables III to V, taken from a report by Ranger Vicente Castillo on a virgin mangrove swamp on Basiad Bay in Tayabas Province, give a good idea of the original composition of a mangrove swamp. In these tables cords are calculated by allowing 30 per cent for air space in stacking. One cord is the equivalent of 3.62 cubic meters.

An examination of these tables shows that the stand of timber in a virgin forest is comparatively heavy.

TABLE III.—*Stand of firewood 10 centimeters and over in diameter on 2.3 hectares. Survey applicable to 440 hectares between Mapinghil and Poctol Point, Capalonga, Tayabas, Luzon.*

[Data from report by Ranger Vicente Castillo.]

Species.	Trees.	Volume.		Species by number of trees.	Species by volume.
		cu. m.	*Cords.*	*Per cent.*	*Per cent.*
Busain	816	146.22	58.49	45.0	55.6
Langarai	620	73.33	29.33	34.2	27.9
Bakauan	257	36.66	14.66	14.2	13.9
Tabigi	74	3.90	1.56	4.0	1.5
Tangal	46	2.21	0.88	2.5	0.8
Pagatpat	2	0.55	0.22	0.1	0.2
Total	1,815	262.87	105.14		
Stand per hectare	789	114.29	45.71		

Table III.—*Stand of firewood 10 centimeters and over, etc.*—Continued.

NUMBER OF TREES AND VOLUME BY DIAMETER CLASSES.

Species.	Diameter class in centimeters. 10. Trees.	10. Volume.	15. Trees.	15. Volume.	20. Trees.	20. Volume.	25. Trees.	25. Volume.
		cu. m.		*cu. m.*		*cu. m.*		*cu. m.*
Busain	100	3.55	124	10.11	267	42.84	237	58.00
Langarai	273	17.17	236	30.76	86	18.15	25	7.25
Bakauan	60	1.58	49	3.54	71	10.04	67	15.40
Tabigi	49	1.61	19	1.45	6	0.84	......	......
Tangal	29	0.78	13	0.91	4	0.52	......	......
Pagatpat	......	......	......	......	......	......	2	0.55
Total	511	24.69	441	46.77	434	72.89	331	81.20

Species.	Diameter class in centimeters. 30. Trees.	30. Volume.	35. Trees.	35. Volume.	40. Trees.	40. Volume.
		cu. m.		*cu. m.*		*cu. m.*
Busain	72	24.17	14	6.55	2	1.00
Langarai	......	......	......	......	......	......
Bakauan	8	5.04	2	1.06	......	......
Tabigi	......	......	......	......	......	......
Tangal	......	......	......	......	......	......
Pagatpat	......	......	......	......	......	......
Total	80	29.21	16	7.61	2	1.00

In Table III busain (*Bruguiera conjugata*) is represented by more individuals and about twice the volume of any other species, and contains more than half the total volume. Langarai (*Bruguiera parviflora*) is the next most numerous species and after busain is represented by a larger volume than any other species. These two species of *Bruguiera* compose 83.5 per cent of the total volume of the stand. Bakauan (*Rhizophora* spp.) contains 13.9 per cent of the total stand. The other species are present in small quantities. The greatest volume is found within the 20- and 25-centimeter diameter classes, these classes composing 58 per cent of the total volume.

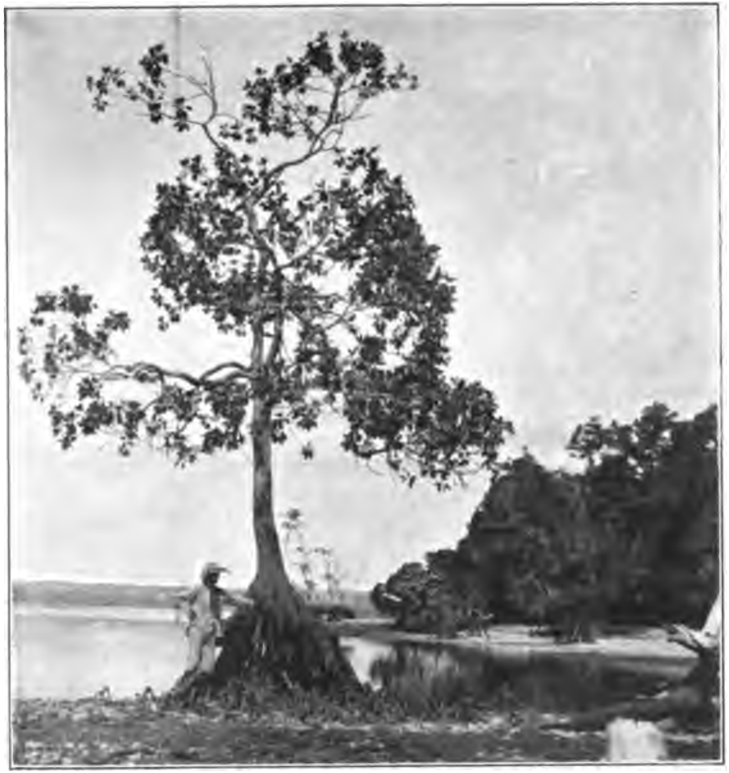

Fig. 1. Pototan tree, along seacoast at low tide.

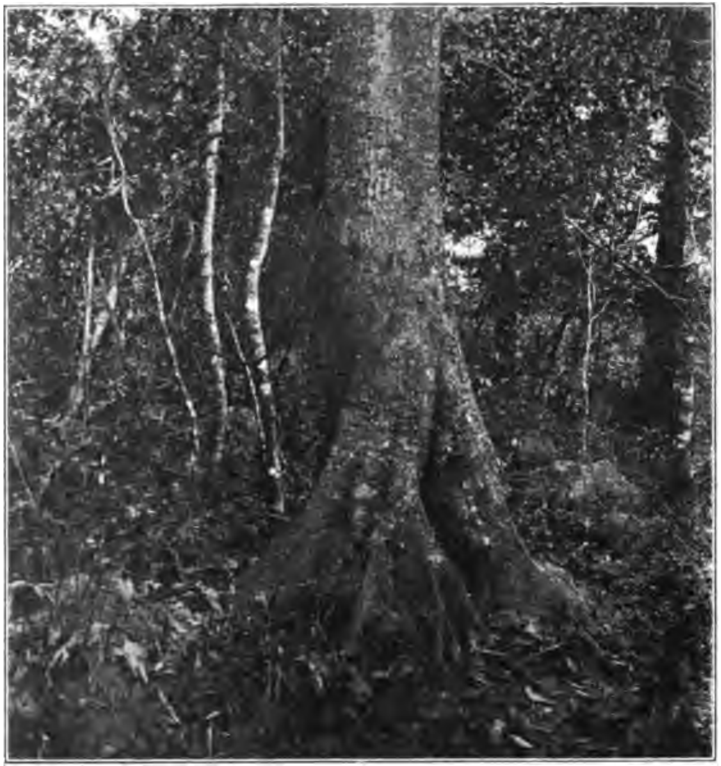

Fig. 2. Pototan; lower trunk and roots.

PLATE XLI.

TABLE IV.—*Stand of firewood 10 centimeters and over in diameter on 3.8 hectares, between Mapinghil Point and Basiad River, Capalonga, Tayabas, Luzon. Survey applicable to 890 hectares.*

[Data from report by Ranger Vicente Castillo.]

Species.	Trees.	Volume.		Species by number of trees.	Species by volume.
		cu. m.	*Cords.*	*Per cent.*	*Per cent.*
Tangal	990	61.19	24.48	41.37	33.06
Bakauan	572	50.99	20.40	23.90	27.55
Busain	358	36.08	14.43	14.96	19.49
Langarai	456	33.46	13.38	19.06	18.08
Pagatpat	6	2.28	0.91	0.25	1.23
Tabigi	11	1.08	0.43	0.46	0.58
Total	2,393	185.08	74.03		
Stand per hectare	629	48.71	19.48		

NUMBER OF TREES AND VOLUME BY DIAMETER CLASSES IN CENTIMETERS.

Species.	Diameter class in centimeters.							
	10.		15.		20.		25.	
	Trees.	Volume.	Trees.	Volume.	Trees.	Volume.	Trees.	Volume.
		cu. m.		*cu. m.*		*cu. m.*		*cu. m.*
Tangal	549	19.28	369	32.05	72	9.86		
Bakauan	211	6.49	212	15.19	81	11.46	60	15.10
Busain	92	2.85	121	9.08	109	15.88	26	5.40
Langarai	243	10.80	183	17.45	30	5.21		
Pagatpat					2	.35		
Tabigi	3	0.24	5	0.31	1	0.13	2	0.40
Total	1,098	39.66	890	74.08	295	42.89	88	20.90

Species.	Diameter class in centimeters.					
	30.		35.		40.	
	Trees.	Volume.	Trees.	Volume.	Trees.	Volume.
		cu. m.		*cu. m.*		*cu. m.*
Tangal						
Bakauan	4	1.19	4	1.56		
Busain	10	2.87				
Langarai						
Pagatpat	2	0.70	1	0.48	1	0.75
Tabigi						
Total	16	4.76	5	2.04	1	0.75

In Table IV tañgal (*Ceriops roxburghiana*) is the most numerous species and is represented by the largest volume. Bakauan (*Rhizophora* spp.) ranks next to tañgal, while busain (*Bruguiera conjugata*) and langarai (*Bruguiera parviflora*) are third and fourth, respectively. The other two species present occur in small quantities. In this table the largest percentage of volume is the 15-centimeter diameter class. In both Tables III and IV the number of individuals is greatest in the smallest diameter class and decreases in the larger classes.

TABLE V.—*Stand of firewood 10 centimeters and over in diameter on 3 hectares, between Basiad and Angas Rivers, Calauag, Tayabas, Luzon. Survey applicable to 720 hectares.*

[Data from report by Ranger Vicente Castillo.]

Species.	Trees.	Volume.		Species by number of trees.	Species by volume.
		cu. m.	*Cords.*	*Per cent.*	*Per cent.*
Bakauan	940	259.00	103.60	39.46	54.23
Langarai	1,002	150.52	60.21	42.07	31.51
Busain	246	32.63	13.05	10.33	6.83
Pagatpat	105	30.29	12.12	4.41	6.34
Tangal	82	4.49	1.79	3.44	0.94
Tabigi	7	0.70	0.28	0.29	0.15
Total	2,382	477.63	191.05	100.00	100.00
Stand per hectare	794	159.21	63.68		

NUMBER OF TREES AND VOLUME BY DIAMETER CLASSES IN CENTIMETERS.

Species.	Diameter class in centimeters.							
	10.		15.		20.		25.	
	Trees.	Volume.	Trees.	Volume.	Trees.	Volume.	Trees.	Volume.
		cu. m.		*cu. m.*		*cu. m.*		*cu. m.*
Bakauan	121	4.90	176	19.93	206	47.69	209	72.73
Langarai	485	30.64	281	42.53	172	46.18	59	27.91
Busain	104	5.48	74	6.97	32	5.96	23	6.81
Pagatpat	1	0.06	13	1.50	26	6.17	52	10.14
Tangal	54	1.79	26	2.10			2	0.60
Tabigi	3	0.09			4	0.61		
Total	768	42.96	570	73.03	440	106.61	345	118.19

TABLE V.—*Stand of firewood 10 centimeters and over, etc.*—Continued.

Species.	Diameter class in centimeters.					
	30.		35.		40.	
	Trees.	Volume.	Trees.	Volume.	Trees.	Volume.
		cu. m.		*cu. m.*		*cu. m.*
Bakauan	146	47.06	53	38.59	29	28.10
Langarai	5	3.26				
Busain	5	2.28	2	1.35	6	3.78
Pagatpat	4	2.77	1	0.96	8	8.69
Tangal						
Tabigi						
Total	160	55.37	56	40.90	43	40.57

In Table V, bakauan (*Rhizophora* spp.) is represented by the largest volume, but *Bruguiera parviflora*, by the greatest number of individuals. Langarai (*Bruguiera parviflora*) ranks next to bakauan (*Rhizophora* spp.) in volume, these two trees composing 86 per cent of the total volume. In this table the greatest percentage of volume is contained in the 20- and 25-centimeter diameter classes.

Forester Rafael Medina has made a valuation survey of 3 hectares between Catubig and Laoang in the mangrove swamps of Samar, to show how much merchantable saw timber over 40 centimeters in diameter can be taken from the mangrove swamps in that region. The results are given in Table VI. There was

TABLE VI.—*Stand of timber 40 cetimeters and over in diameter on 3 hectares between Catubig and Laoang, Samar.*

[Data from report by Forester Rafael Medina.]

Species.	Per cent of each species by number of trees.	Trees.	Logs.	Average number of logs per tree.	Volume.		Average volume per tree.	
					cu. m.	*bd. ft.*	*cu. m.*	*bd. ft.*
Api-api	49.04	741	741	1	31.28	7,820.0	0.042	10.5
Bakauan	23.69	358	358	1	17.19	4,297.5	0.048	12.0
Busain	16.61	251	251	1	9.33	2,332.5	0.037	9.3
Tabigi	8.67	131	131	1	8.20	2,050.0	0.063	15.6
Tangal	1.99	30	30	1	1.10	275.0	0.037	9.2
Total	100	1,511	1,511		67.10	16,775.0	[a]0.045	[a]11.3
Per hectare		504	504		22.37	5,592.0		

[a] Average.

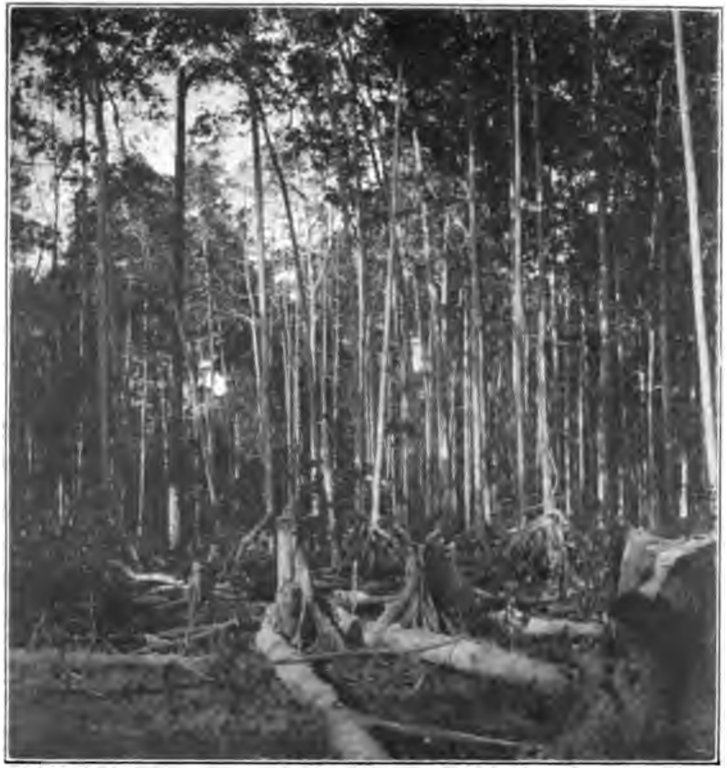

Fig. 1. Mangrove swamp. Stumps of Ceriops in foreground. Trees of Rhizophora and Bruguiera.

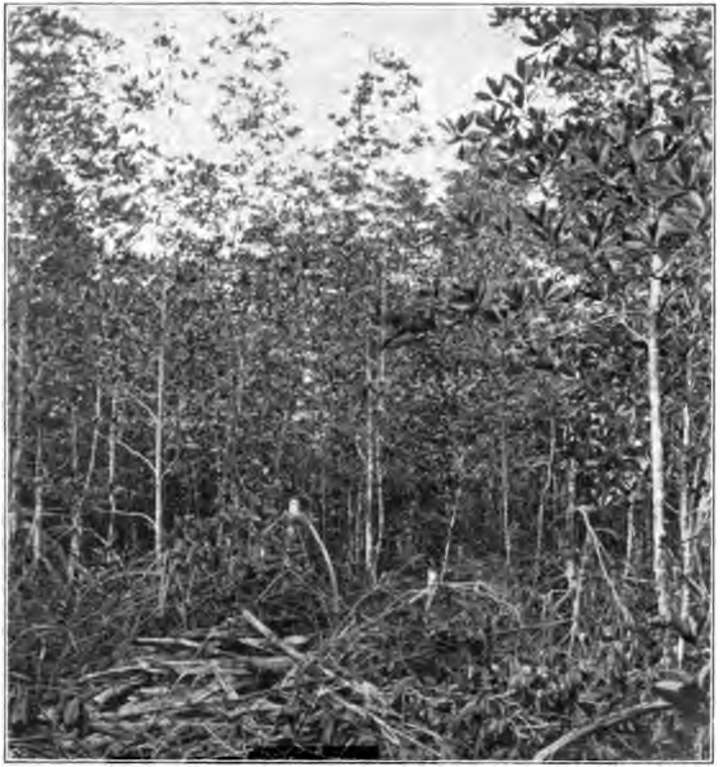

Fig. 2. Mangrove swamp. Bakauan rajitas in foreground.

PLATE XLII.

an average volume of 22.37 cubic meters in trees more than 40 centimeters in diameter. No trees produce on the average more than one log 5 meters in length. The most numerous tree was api-api (*Avicennia*), and the next was bakauan (*Rhizophora* spp.). The third most numerous species was busain (*Bruguiera sexangula*). The wood of api-api (*Avicennia*) is of comparatively little value, but is extensively used as firewood. That of the other species is very valuable.

Forester Medina has also made valuation surveys of other stands in Samar. The results are given in Tables VII to XI. In all of these tables, bakauan (*Rhizophora* spp.) is the most numerous tree. The second most numerous is api-api (*Avicennia*). This species, however, is very much less numerous than bakauan (*Rhizophora* spp.) and is represented by a much smaller volume. In Table VIII, langarai (*Bruguiera parviflora*) ranks next to bakauan (*Rhizophora* spp.) and api-api (*Avicennia*) third. The average volume per hectare in the different areas varies from 13.77 to 120.87 cubic meters. These tables represent swamps which have been used to some extent for the collection of firewood.

TABLE VII.—*Stand of firewood 5 centimeters and over in diameter, between Pinamacdan River and Matnog Creek, Samar. Valuation survey taken on 6.35 hectares. Applicable to 2,710 hectares.*

[Data from report by Forester Rafael Medina.]

Species.	Per cent of each species by number of trees.	Trees.	Logs.	Average number of logs per tree.	Volume.	
					cu. m.	*Cords.*
Bakauan	70.02	1,009	3,088	3.1	68.63	27.45
Api-api	13.88	200	449	2.2	9.78	3.91
Pagatpat	9.58	138	249	1.8	3.64	1.45
Pototan	2.08	30	94	3.1	1.84	0.74
Langarai	2.29	33	125	3.8	1.60	0.64
Tabigi	1.66	24	59	2.5	1.50	0.60
Tabau	0.21	3	13	4.3	0.22	0.09
Tangal	0.28	4	7	1.8	0.20	0.08
Total	100.00	1,441	4,084		87.41	34.96
Stand per hectare		227	643		13.77	5.50

TABLE VII.—*Stand of firewood 5 centimeters and over, etc.*—Continued.

NUMBER OF LOGS BY DIAMETER CLASSES.

Species.	Diameter class in centimeters.		
	5-10.	10-20.	20-30.
Bakauan	1,152	1,611	325
Api-api	199	188	62
Pagatpat	146	103	
Pototan	48	43	3
Langarai	95	27	8
Tabigi	14	38	7
Tabau	8	5	
Tangal		7	
Total	1,662	2,022	400

TABLE VIII.—*Stand of firewood 5 centimeters and over in diameter, between Motiong Creek and Pinamacdan River, Samar. Valuation survey taken on 9.05 hectares. Applicable to 3,110 hectares.*

[Data from report by Forester Rafael Medina.]

Species.	Per cent of each species by number of trees.	Trees.	Logs.	Average number of logs per tree.	Volume.	
					cu. m.	*Cords.*
Bakauan	50.93	3,988	11,879	3.0	597.31	238.92
Langarai	27.19	2,129	7,086	3.3	350.29	140.12
Api-api	10.38	813	2,066	2.5	64.97	25.99
Pagatpat	4.23	331	926	2.8	45.72	18.29
Tabigi	6.47	507	992	1.9	27.90	11.16
Dungon-late	0.49	39	105	2.7	6.15	2.46
Pototan	0.22	17	38	2.2	1.35	0.54
Tabau	0.09	7	16	2.3	0.22	0.09
Total	100.00	7,831	23,108		1,093.91	437.57
Stand per hectare		865	2,553		120.87	48.35

NUMBER OF LOGS BY DIAMETER CLASSES.

Species.	Diameter class in centimeters.			
	10-20.	20-30.	30-40.	40-50.
Bakauan	3,817	3,155	2,347	2,560
Langarai	2,347	1,800	1,357	1,582
Api-api	1,080	545	303	138
Pagatpat	236	258	116	316
Tabigi	491	332	147	22
Dungon-late	34	19	27	25
Pototan	6	5	10	17
Tabau	12	4		
Total	8,023	6,118	4,307	4,660

TABLE IX.—*Stand of firewood 5 centimeters and over in diameter, between Dapdap River and Motiong Creek, Samar. Valuation survey taken on 14 hectares. Applicable to 1,080 hectares.*

[Data from report by Forester Rafael Medina.]

Species.	Per cent of each species by number of trees.	Trees.	Logs.	Average number of logs per tree.	Volume.	
					cu. m.	*Cords.*
Bakauan	56.84	4,099	9,259	2.3	472.59	189.04
Api-api	25.02	1,804	4,250	2.4	144.34	57.74
Pagatpat	6.74	486	1,052	2.2	53.23	21.29
Langarai	3.49	252	808	3.2	39.74	15.90
Dungon-late	3.01	217	547	2.5	29.83	11.93
Pototan	2.09	151	346	2.3	20.30	8.12
Tabigi	2.32	167	323	1.9	18.94	7.58
Tangal	0.49	35	49	1.4	2.15	0.86
Total	100.00	7,211	16,634		781.12	312.46
Stand per hectare		515	1,188		55.79	22.32

NUMBER OF LOGS BY DIAMETER CLASSES.

Species.	Diameter class in centimeters.			
	10-20.	20-30.	30-40.	40-50.
Bakauan	2,721	1,858	1,893	2,787
Api-api	2,388	936	465	461
Pagatpat	393	191	241	227
Langarai	298	227	165	118
Dungon-late	169	148	91	139
Pototan	95	72	85	94
Tabigi	121	51	61	90
Tangal	28	7	5	9
Total	6,213	3,490	3,006	3,925

TABLE X.—*Stand of firewood 5 centimeters and over in diameter, between Carayman or Bongon River and Dapdap River, Samar. Valuation survey taken on 11.5 hectares.. Applicable to 4,360 hectares.*

[Data from report by Forester Rafael Medina.]

Species.	Per cent of each species by number of trees.	Trees.	Logs.	Average number of logs per tree.	Volume.	
					cu. m.	*Cords.*
Bakauan	63.09	2,748	6,202	2.2	335.47	184.19
Api-api	15.15	660	1,334	2.0	74.35	29.74
Langarai	8.10	353	1,070	3.0	67.77	27.11
Tabigi	5.26	229	505	2.2	60.14	24.06
Dungon-late	3.67	160	364	2.3	26.49	10.60
Pagatpat	3.67	160	401	2.5	26.41	10.56
Pototan	1.06	46	147	3.2	11.82	4.73
Total	100.00	4,356	10,023		602.45	240.99
Standard per hectare		379	872		52.38	20.96

NUMBER OF LOGS BY DIAMETER CLASSES.

Species.	Diameter class in centimeters.							
	10-20.	20-30.	30-40.	40-50.	50-60.	60-70.	70-80.	80-90.
Bakauan	2,058	1,445	1,155	1,544				
Api-api	401	315	260	358				
Langarai	136	365	296	273				
Tabigi	57	135	129	135	9	7	7	26
Dungon-late	75	70	70	149				
Pagatpat	89	89	91	132				
Pototan	14	18	60	55				
Total	2,830	2,437	2,061	2,646	9	7	7	26

TABLE XI.—*Stand of firewood 5 centimeters and over in diameter, between Barrio Peña and Carayman or Bongon River, Samar. Valuation survey taken on 1 hectare. Applicable to 300 hectares.*

[Data from report by Forester Rafael Medina.]

Species.	Per cent of each species by number of trees.	Trees.	Logs.	Average number of logs per tree.	Volume.	
					cu. m.	*Cords.*
Bakauan	55.77	266	619	2.3	33.83	13.53
Api-api	24.74	118	195	1.6	11.96	4.78
Pagatpat	9.22	44	129	2.9	6.76	2.70
Tabigi	8.38	40	88	2.2	6.31	2.52
Dungon-late	1.89	9	18	2.0	1.32	0.53
Total	100.00	477	1,049		60.18	24.06

NUMBER OF LOGS BY DIAMETER CLASSES.

Species.	Diameter class in centimeters.			
	10-20.	20-30.	30-40.	40-50.
Bakauan	198	150	96	175
Api-api	53	60	26	56
Pagatpat	39	43	15	32
Tabigi	15	15	27	31
Dungon-late	4	2	6	6
Total	309	270	170	300

SWAMP CULTIVATION IN MANILA BAY

Cultivated swamps are found in the whole region around the upper part of Manila Bay, from Malabon on the east to Balanga on the west side; here, the virgin mangle has long since disappeared. The extent of the area covered by this cultivation has not been determined; but, in places, it extends 20 or more kilometers inland from the bay. Extensive reports on the cultivation of bakauan (*Rhizophora* spp.) in the above region have been made by Dr. F. W. Foxworthy and Ranger De Mesa. The following information is taken from their reports:

Nipa and bakauan are planted extensively in solid stands, but there is little planting of other swamp species.

Hundreds, and may be thousands, of hectares are planted to bakauan, which is grown for firewood, and sold principally in the Manila market, this wood being preferred to almost all others for fuel. The Manila supply is inadequate, as is indicated by the remarkably complete utilization of the swamps in the vicinity, and by the use of other and inferior species.

No records seem to exist as to how, when, and where bakauan was first cultivated, but it is safe to say that the present planting methods have been in use for at least three generations. An evident reason for the cultivation is the large agricultural population on the level lands of Pampanga Province and the accessibility of the Manila market.

In the municipalities of Macabebe, Guagua, Lubao, Sexmoan, and Orani there are a number of barrios along the rivers which have a population that divides its labor among the fishing, bakauan, and nipa industries.

PLANTING AND CULTIVATION

The land chosen for planting bakauan is brackish or salt swamp, at or near the edge of a river in places which are affected by the tide. Nipa and bakauan are often planted in the same kind of mud. Very soft muddy soil is said to be the best for bakauan; and on such soil it makes its most rapid growth. On comparatively firm mud, it grows far more slowly, sometimes requiring much more than twice as long to produce a crop as when grown on the very soft mud. Freshly deposited soft mud at the edge of a stream, even though the strip may be no more than 2 meters in width, is eagerly appropriated for new planting.

The unit of area used in the mangrove cultivation is the "luang," which is 279.56 square meters. There are thus 35.77 luangs in 1 hectare.

If the ground which is to be planted has not been in cultivation for some time, it is covered with a dense tangle of low shrubs and vines. These are, for the most part, the low shrubby diliuariu (*Acanthus ilicifolius* L.); the spiny, woody vine known as sapinit [*Caesalpinia nuga* (L.) Ait.]; and several small, low-growing vines.

The land must be thoroughly cleared before planting. This is a difficult task and usually costs 2 pesos per luang, sometimes 2.50 pesos per luang. This would mean the work of two men for about two days. The clearing consists in cutting off the brush, pulling up or digging up the roots, if this is possible, and filling and leveling crab holes.

Clearing is reduced to a minimum by promptly replanting cut-over areas. After bakauan has been harvested, the ground may be left idle for from four months to a year, or until the bark on the roots is evidently rotten. The area can then be replanted without any new clearing being necessary.

The seedlings are frequently gathered from special seed trees which are left for this purpose. Often low-growing or dwarf trees near the edge of the stream are selected for the production of seed, as it is easier to collect seed from small than from large trees. This results in the use of rather small seedlings.

These are gathered at a cost of from 2 to 3 pesos per thousand. The higher price is given for prompt delivery and when cash payment is made. The smaller sum is paid when the money is given as an advance, several months before the performance of the work. The advance-payment method seems to be the one in commoner use. In some places, bakauan-lalaki seedlings are paid for at the rate of 2 or 3 pesos per thousand and bakauan-babae at 3 or 4 pesos per thousand. The bakauan-lalaki seedlings are smaller and more numerous and are, therefore, easier to collect than those of bakauan-babae. If the seedlings were placed 100 centimeters apart, 10,000 would be required to plant a hectare. If they were only 20 centimeters apart, 250,000 would be required.

After gathering, the seedlings are placed in a shady place and allowed to wilt for about two weeks. This is said to render them resistant to the attacks of crabs and other marine animals, which would eat them if they were planted perfectly fresh.

The principal planting season appears to be from May to August. May seems to be considered a less desirable month for planting than are the others, as the seedlings are said to be rather small during that month.

In planting, the seedlings are simply shoved a short distance into the mud, so that they will stand erect. They are spaced 40 to 100 centimeters apart. In some of the places visited, the seedlings were as close together as 20 centimeters. The most usual spacing seemed to be from 40 to 60 centimeters.

The planting may be done very rapidly, as a man can go almost at a run and plant two luangs or more per day. From 50 centavos to 1.20 pesos are paid for the planting of 10,000 plants.

The young plants are killed, if they are submerged for as long as three days; or if there is a flood while the plants are young, the excess of fresh water will kill many.

Young plantations at the edge of the river are protected from damage from floating objects by a fence of branches stuck in the mud or by a planted hedge of pagatpat (*Sonneratia* spp.). Sometimes a line of older bakauan trees is left to protect a new plantation. Bakauan-babae is usually planted along the edge next the stream, while bakauan-lalaki makes up most of the stand back of the bakauan-babae.

After the first year, it is customary to replant any blank spaces left by the death or destruction of any of the stand.

Cultivation consists principally in keeping the plantation clear of vines. It is said that it is sometimes necessary to cut out the vines each year. Usually there is very little of this to do; and, in many cases, there is no occasion to do it at all. The cost of this weeding is hard to estimate, because the man who does the work usually devotes only a part of his time to it. A man is able to do all the weeding for a large plantation, guard the plantation from thieves, and still have a considerable part of his time to spend in fishing. It seems that the cost of weeding is never a large item.

In some cases, where it is considered that the plants are too far apart, the terminal bud is split during the second year. This is said to cause the plants to form two or more trunks, thus filling up the space more completely.

During the first year, a plant produces from two to four pairs of leaves and does not grow much more than half a meter in height. At this time rather fleshy underground roots are formed and the whole plant is more herbaceous than woody in texture. In the second year the plant begins to branch at the top and to send out prop roots, while the stem become partly woody. During the third year the plant becomes stout and woody, while in succeeding years it makes height growth and thickens more symmetrically.

With the very close planting which is the rule, the plants grow very slender and straight. The dense shade produced, in time, causes self-pruning. Self-pruning is regarded as indicating that the bakauan is ready for cutting. Self-pruning takes place seven to twelve or more years after planting, according to the character of the soil.

Only small firewood sizes are grown. Material large enough for rajas[1] is very rarely seen.

Hacenderos all agree that the individual tree will grow more rapidly and will reach a larger size, if it is given more room. They feel confident, however, that they would lose money if they planted at a greater interval; as they would have fewer trees. However, planting at an interval at least twice as wide as is commonly used would probably be a profitable experiment.

Bakauan-babae is said to grow more rapidly than does bakauan-lalaki; but it is much more inclined to be crooked, and its wood is not so good.

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[1] Rajas are sticks of firewoods split from sections of trunks 8 to 15 centimeters in diameter and 80 to 100 centimeters in length. Trunks 10 centimeters in diameter are split into four pieces; those 20 centimeters in diameter into six or eight pieces. Rajitas are smaller and are split from sections of trunks, branches, and roots ranging from 1 to 3 centimeters in diameter and from 60 to 70 centimeters in length. Three centimeter sticks are split into two or four pieces.

Bakauan-babae begins to flower in its third year, but is said not to bear fertile fruit till the fourth or fifth year.

In going hurriedly through the swamp in a boat, one gets the impression that more bakauan-babae is planted than bakauan-lalaki. This is because the bakauan-babae is planted at the edge of the stream.

CUTTING

Different practices in cutting are followed in different localities. In the Sexmoan and Guagua neighborhoods, the cutting is often done by contract. The owner gives the contractor one-half of the cut and furnishes the bancas for transportation. In such cases, the woody prop roots do not enter into the contract and are the property of the cutter, if he chooses to take them. It is said, however, that the owner can make a larger profit by employing his own men to do the cutting.

The firewood is regularly of three grades. The first grade is about 60 centimeters in length and 2 or 3 centimeters in thickness. It is split from the pieces of larger diameter and, locally, has a value of 2 pesos per thousand. The second grade is of the same length as the first, but is split from pieces of smaller diameter. It sells locally for 1 peso per thousand. The third grade is made of pieces which are shorter and of still smaller diameter. This grade sells locally for 2 pesos per 10,000 pieces.

Wood cutters, who cut the trees in the swamp, transport the poles to the wood yard, and split them there, are paid 0.625 peso per 1,000 pieces of the first grade, 0.625 peso per 2,000 of the second grade, and 0.625 peso per 10,000 pieces of the third grade. Consequently the cutter does not know just how much he will receive until the pieces have been split. The cutter takes the poles from the swamp in a banca and delivers them at his own or some other wood yard, where they are cut into firewood size. This splitting into firewood is often done by women and children. Only the straight pieces are cut up for firewood. The splitting is either done with a special, heavy-bladed, long-handled bolo, which is used with a chopping movement like an ax; or with a special, short-bladed, narrow ax.

The small air-roots of the bakauan are sometimes sold after being split once. They then bring about 50 centavos per thousand. They are not regularly classified, and often are not cut but are left to decay in the swamp.

The straight and slender tops of the bakauan, which are about 4 meters long, a centimeter in diameter at the top, and

2 or 3 centimeters in diameter at the base, are often sold to planters of ikmo (betel pepper) at 12 pesos per 100.

The very rough pieces, particularly those that occur where the prop roots are joined to the trunk, are used in making charcoal. The bark is also occasionally used for cooking, especially in the roasting of corn. This use does not seem to be general enough to have fixed a market price.

Ranger De Mesa has made a careful count of the number of the trees on several plots in bakauan plantations. The results are given in Tables XII to XIV. These tables show the number of trees of different lengths and diameters and the volume according to the length and diameter of the trees, also, the total number of trees and the total volume, and the percentage of trees and volume in the different length classes. In the lower portion of the table is shown the number, grades, and volume of the rajitas obtained by cutting and splitting the trees.

TABLE XII.—*Measurements of planted bakauan-lalaki near Orani, Bataan, at age of 7 years on 0.1 hectare (50 by 20 meters).*

[Data from report by Ranger De Mesa.]

Diameter class in cm.		Length class in meters.				Total.
		2.	3.	4.	5.	
2	Trees	454	300	189	104	1,047
	Volume in cu. m.	0.285	0.283	0.238	0.163	0.969
3	Trees		120	187	309	616
	Volume in cu. m.		0.254	0.529	1.092	1.875
4	Trees		50	165	376	591
	Volume in cu. m.		0.188	0.829	2.362	3.379
5	Trees			7	301	308
	Volume in cu. m.			0.055	2.955	3.010
Total	Trees	454	470	548	1,090	2,562
	Volume in cu. m.	0.285	0.725	1.651	6.572	9.233
Percentage of stand by	Trees	17.72	18.35	21.39	42.54	100.00
	Volume in cu. m.	3.09	7.85	17.88	71.18	100.00

STACKED RAJITAS.

Grade of rajitas.	Pieces.	Volume.
		cu. m.
First	12,650	7.80
Second	22,195	6.40
Third	500	0.22
Stumps		1.50
Total	35,345	15.92

TABLE XIII.—*Measurements of planted bakauans, near Orani, Bataan, at age of 8 years on 0.1 hectare (50 by 20 meters).*

[Data from report by Ranger De Mesa.]

Species.	Diameter class in cm.		Length class in meters.				Total.
			3.5	4	5	6	
Bakauan-lalaki	2	Trees	331	278	177		786
		Volume in cu. m.	0.364	0.349	0.278		0.991
Do	3	Trees		104	234	60	398
		Volume in cu. m.		0.294	0.837	0.254	1.385
Do	4	Trees			161	426	587
		Volume in cu. m.			1.012	3.212	4.224
Do	5	Trees			19	292	311
		Volume in cu. m.			1.865	3.440	5.305
Do	6	Trees			72	16	88
		Volume in cu. m.			1.018	0.271	1.289
Bakauan-babae	8	Trees		4		16	20
		Volume in cu. m.		0.064		0.387	0.451
Do	12	Trees				16	16
		Volume in cu. m.				1.086	1.086
Total		Trees	331	386	663	826	2,206
		Volume in cu. m.	0.364	0.707	5.01	8.65	14.731
Percentage of stand by		Trees	15.01	17.50	30.05	57.44	100.00
		Volume in cu. m.	2.48	4.79	34.01	58.72	100.00

STACKED RAJITAS.

Grade of rajitas.	Pieces.	Volume.
		cu. m.
First	13,400	8.011
Second	23,400	6.425
Third	1,800	0.504
Stumps		3.42
Total	38,600	18.36

TABLE XIV.—*Measurements of planted bakauan-lalaki near Sexmoan, Pampanga, at age of 7 years on 0.1 hectare (50 by 20 meters).*

[Data from report by Ranger De Mesa.]

Diameter class in cm.		Length class in meters.			Total.
		3.	4.	5.	
2	Trees	214	280	72	566
	Volume in cu. m.	0.201	0.352	0.113	0.666
3	Trees	200	246	262	708
	Volume in cu. m.	0.424	0.696	0.926	2.046
4	Trees		240	560	800
	Volume in cu. m.		1.206	3.519	4.725
5	Trees		30	160	190
	Volume in cu. m.		0.236	1.571	1.807
Total	Trees	414	976	1,054	2,264
	Volume in cu. m.	0.625	2.49	6.129	9.244
Percentage of stand by	Trees	18.29	35.16	46.55	100.00
	Volume in cu. m.	6.76	26.94	66.30	100.00

STACKED RAJITAS.

Grade of rajitas.	Pieces.	Volume.
		cu. m.
First	5,560	4.774
Second	17,600	7.825
Stumps		5.367
Total	23,160	17.966

The trees measured in Table XII were cut by six laborers, each working three hours a day for four days; those in Table XIII by four laborers working two to three hours a day for four days; and those in Table XIV by four laborers working half a day for three days.

The results in Tables XII and XIV were obtained from plantations 7 years old. The total volume in each on 0.1 hectare was 9.2 cubic meters. The trees recorded in Table XIII were 8 years old and showed a volume of 14.7 cubic meters on 0.1 hectare. The volume of stacked rajitas was in every case much greater than the volume obtained by measuring the trees. This difference was caused by the space occupied by air spaces.

MARKETING OF BAKAUAN

Manila is the market place for most of the bakauan grown around Manila Bay, and transportation is naturally by water. The firewood is loaded into cascoes which are towed to Manila by launches. The charcoal is loaded on the regular steamer and pays a freight charge of 5 centavos per sack.

The first-grade rajitas sell in Manila and Malabon at from 3 to 4 pesos per 1,000 pieces; the second grade, from 3 to 4 pesos per 2,000 pieces; the third grade, from 3 to 4 pesos per 10,000 pieces; and the fourth grade, from 3 to 3.50 pesos per 4 cubic meters.

In Table XV are given the figures on cost of transporation from Bataan to Manila.

TABLE XV.—*Cost of transportation of firewood from Bataan to Manila.*

[Data from report by Ranger De Mesa.]

	Pesos.
Second-class casco with a load of 70,000 first-grade rajitas (7 to 14 days' trip)	[a] 1.50
Crew of 5 men at 3 pesos each and 1 pilot at 6 pesos (1 trip)	21.00
Subsistence of crew while on trip	8.00
First-class casco with a load of 100,000 first-grade rajitas (7 to 14 days' trip)	[a] 2.00
Crew of 6 men at 4 pesos each and 1 pilot at 8 pesos (1 trip)	32.00
Subsistence of crew while on trip	10.00

From the figures given in Tables XII and XIII, we have made rough estimates of the total cost, selling price, and profits derived from 1 hectare of a bakauan plantation. These figures are given in Tables XVI and XVII.

TABLE XVI.—*Cost and sale value in Manila of the crop of bakauan on 1 hectare, based on figures in Table XII for crop 7 years old.*

	Pesos.	
PLANTING COST.		
Clearing at 2 pesos per luang	72.00	
Seedlings, 25,620 at 2 pesos per 1,000	51.00	
Planting at 0.75 peso per 1,000	19.00	
Compound interest on planting cost for seven years at 5 per cent	58.00	
Total planting cost		200.00
HARVESTING AND SELLING COST.		
Cutting and splitting 126,500 first-grade rajitas at 0.625 peso per 1,000	79.00	
Cutting and splitting 221,900 second-grade rajitas at 0.625 peso per 2,000	69.00	
Transportation 126,500 first-grade rajitas at 62 pesos per 100,000	78.00	
Transportation 221,900 second-grade rajitas at 40 pesos per 100,000	89.00	
Total harvesting and selling cost		315.00
Total cost		515.00

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[a] Daily.

SELLING PRICE.

126,500 first-grade rajitas at 3.50 pesos per 1,000	443.00
221,900 second-grade rajitas at 3.50 pesos per 2,000	388.00
Total selling price	831.00
Total cost	515.00
Total profit	316.00
Profit for one year	45.00
Profit per year based on cost of original planting (per cent)	32

TABLE XVII.—*Cost and sale value in Manila of the crop of bakauan on 1 hectare, based on figures in Table XIII for crop 8 years old.*

PLANTING COST.

	Pesos.	
Clearing at 2 pesos per luang	72.00	
Seedlings, 22,060 at 2 pesos per 1,000	44.00	
Planting at 0.75 peso per 1,000	17.00	
Compound interest on planting cost for 8 years at 5 per cent	64.00	
Total planting cost		197.00

HARVESTING AND SELLING COST.

Cutting and splitting 134,000 first-grade rajitas at 0.625 peso per 1,000	84.00	
Cutting and splitting 234,000 second-grade rajitas at 0.625 peso per 2,000	73.00	
Cutting and splitting 18,000 third-grade rajitas at 0.625 peso per 10,000	1.00	
Transportation of 134,000 first-grade rajitas at 62 pesos per 100,000	83.00	
Transportation of 252,000 second- and third-grade rajitas at 40 pesos per 100,000	101.00	
Total harvesting and selling cost		342.00
Total cost		539.00

SELLING PRICE.

134,000 first-grade rajitas at 3.50 pesos per 1,000	469.00
234,000 second-grade rajitas at 3.50 pesos per 2,000	409.00
18,000 third-grade rajitas at 3.50 pesos per 10,000	6.00
Total selling price	884.00
Total cost	539.00
Total profit	345.00
Profit per year	43.00
Profit per year based on original planting cost (per cent)	32

The value of the land is not taken into consideration, because the area in cultivation is really a part of the shore line, or perhaps of the sea, and properly belongs to the Government. No account is taken of the cost of supervision, as it is very difficult to arrive at an estimate of this. However, a bakauan plantation takes but little supervision and so this item is probably very small. From the figures given in Tables XVI and XVII, it would appear that raising bakauan should be profitable. It would appear further that it is much more profitable to market the crop in Manila than where it is grown. This is brought out in Table XVIII, in which the cost and selling price in Bataan are shown.

TABLE XVIII.—*Cost and selling prices in Bataan of the crop of bakauan on 1 hectare, based on figures in Table XIII for crop 8 years old.*

SELLING PRICE.	Pesos.
134,000 first-grade rajitas at 2 pesos per 1,000	268.00
234,000 second-grade rajitas at 1 peso per 1,000	234.00
18,000 third-grade rajitas at 2 pesos per 10,000	4.00
Stumps, 34.2 cubic meters at 2 pesos per cubic meter	17.00
Total selling price	523.00
Cost of clearing, seedlings, planting, and harvesting, with interest on planting	355.00
Total profit	168.00
Profit per year	21.00
Profit per year based on original planting cost (per cent)	16

If sold in Manila, it will be seen that the profit per year, based on the planting cost, is 32 per cent plus 5 per cent compound interest, which is calculated in the tables as a part of the cost. When the wood is sold where grown, the calculated profit per year is 16 per cent plus the interest on the planting cost. About half of the original planting cost as calculated is due to clearing, which is frequently not necessary, perhaps never so for the second crop, if the planting is done at the right time. Where clearing is unnecessary, the percentage of profit would be much greater than that calculated.

When bakauan is planted on bare ground in shallow water, the roots by holding sand or mud on the area have a tendency to raise the level of the ground. When the land has been raised to about the level of high tide, the bakauan is frequently cut for firewood and the area made into fish ponds by the construction of dikes. The water in these ponds is usually brackish. In the Philippines, there is a considerable industry in the raising of the fish *Chanos chanos* Forskål, locally known as bañgós, in such ponds. As the raising of fish is a very profitable business, old bakauan plantations are frequently converted into fish ponds. In many places the growing of a crop of bakauan and the subsequent use of the land for fish ponds should be an exceptionally profitable investment. There are large areas in Manila Bay where this could be undertaken.

MANGROVE-SWAMP FIREWOOD

The demand for fuel in the Philippines, excepting in the case of transportation companies and manufacturing plants, is met almost entirely by the use of firewood, as up to the present time comparatively little coal has been mined in the Archipelago and most of the supply comes from Japan. The coal industry in the Philippines is being developed, and 3,200 tons were mined in 1917.† The demand for fuel in a tropical country, such as the Philippines, is not nearly so great as in a temperate region; nevertheless, there is a large demand for domestic purposes, such as cooking, washing, etc., and for the smaller industries.

The most highly prized firewood is furnished by various species of mangrove-swamp trees. However, the available, accessible supply of these is not great enough to satisfy the demand and dry-land species have to be substituted. The amount of firewood of both classes on which taxes were paid in the Archipelago from 1914 to 1918, inclusive, is given in Table XIX.

TABLE XIX.—*Amount of firewood on which taxes were paid in the Philippine Islands from 1914 to 1918.*

Year.	Mangrove species.	Dry-land species.
	cu. m.	*cu. m.*
1914	28,120	133,274
1915	70,427	142,814
1916	97,856	194,480
1917	130,472	277,224
1918	134,431	588,109

From this table, it will be seen that during each successive year the amount of mangrove-swamp wood used has been greatly increased and that there has been a corresponding increase in the dry-land species; and further, that in every case, the amount of the dry-land species was each year more than twice as great as that of mangrove species. The figures in Table XIX show that the firewood business in the Philippine Islands is one of considerable proportions.

An extensive study of mangrove-swamp woods has been made by Cox.* In Table XX are given the results of analyses and calorific determinations made by him on air-dried wood without bark. In this table the dried wood is taken as the basis on which to compute the percentages of moisture and ash. From the table

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† Cox, Alvin J., Annual Report of the Director, Bureau of Science, for 1918.

* Cox, Alvin J., Philippine firewood, Philippine Journal of Science, Sec. A, Vol. 6 (1911), page 1.

* Cox, Alvin J., Philippine fuels, Bureau of Science Press Bulletin No. 86.

TABLE XX.—*Analyses and calorific determinations of air-dried wood without bark.*

[The numbers and common names are those given by Cox in the original table. The scientific names have been inserted by Mr. E. E. Schneider, wood expert of the Bureau of Forestry, after a recent examination of specimens of the wood used by Cox.]

No.	Common and scientific names.	Moisture.	Ash.	Main calories.[a]	Available heating value.	Heating value of combustible matter, wood — (water + ash) in main calories.[a]	Available heating value of combustible matter, wood — (water + ash).
		Per cent.	*Per cent.*		*Calories.*		*Calories.*
3	Pototan (*Bruguiera conjugata*)	13.01	1.46	4,180	3,833	4,798	4,480
		13.26	1.44	4,191	3,829	4,793	4,475
4	Bacauan (*Rhizophora mucronata*).	11.22	2.23	4,118	3,772	4,689	4,365
		11.37	2.29	4,107	3,746	4,682	4,358
5	Bacao (*Bruguiera* sp.)	11.03	1.81	4,159	3,781	4,699	4,340
		10.94	1.74				
6	Bacauan-tubig (*Bruguiera* sp.)	13.21	5.75	3,753	3,366	(b)	(b)
			5.57				
7	Catutan (*Bruguiera* sp.)	13.79	1.28	4,142	3,705	4,787	4,368
		13.77	1.29				
8	Tabigue (*Xylocarpus moluccensis*).	13.93	2.80	4,005	3,634	4,694	4,345
9	Bacauan (*Bruguiera* sp.)	13.77	2.05	4,066	3,764	4,723	4,456
		13.39	2.12				
10	Tambu-tambu (*Xylocarpus moluccensis*).	12.99	2.72	4,162	3,873	4,823	4,578
		12.99	2.71				
11	Pagatpat (*Sonneratia caseolaris*).	14.27	2.62	4,116	3,841	4,831	4,596
		14.27	2.65				
14	Bacauan (*Rhizophora candelaria*).	10.71	2.41	4,136	3,721	4,689	4,284
			2.26	4,154	3,760	4,720	4,328
15	Tangal (*Ceriops tagal*)	11.41	1.60	4,292	3,924	4,747	4,399
				4,293	3,906	4,747	4,378
16	Pototan (*Bruguiera conjugata*)	12.26	1.55	4,286	3,896	4,840	4,466
				4,227	3,855	4,773	4,421
17	Lenggadi (*Bruguiera parviflora*).	11.97	1.65	4,072	3,716	4,629	4,296

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[a] In the usual determination of the calorific value of a fuel in a calorimeter the products are cooled to the ordinary temperature and the result is therefore higher than can ever be realized in ideal practice, where the resulting gases always leave the flues at a temperature above 100°. Since the object of the determination of the calorific value of a fuel is to show its technical worth, I always have calculated the results on Philippine fuels on the assumption that the moisture present and the water formed during the combustion remain as steam at 100°, i. e., I have made a water correction by subtracting 6 calories for each per cent of water. Some mechanical engineers do not make this correction, and therefore obtain a result from 3 to 10 per cent too high, and in order that my results may be comparable in all cases I have decided to give also the uncorrected result under the caption "Main calories."

[b] On account of the very high ash content and the possibility of error in its determination (cf. p. 10), this sample has little comparative value and I have therefore not included the heating value of the combustible matter in the average. The calculated results for the combustible matters wood — (water + ash), in main calories and available calories are 4,482 and 4,123, respectively.

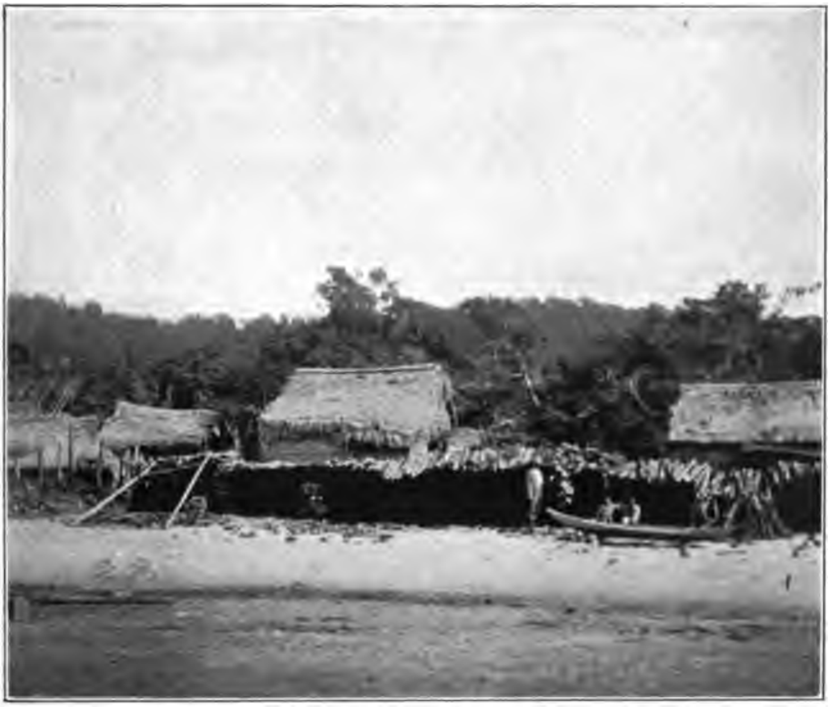

Fig. 1. Piled firewood cut mainly from tañgal and bakauan.

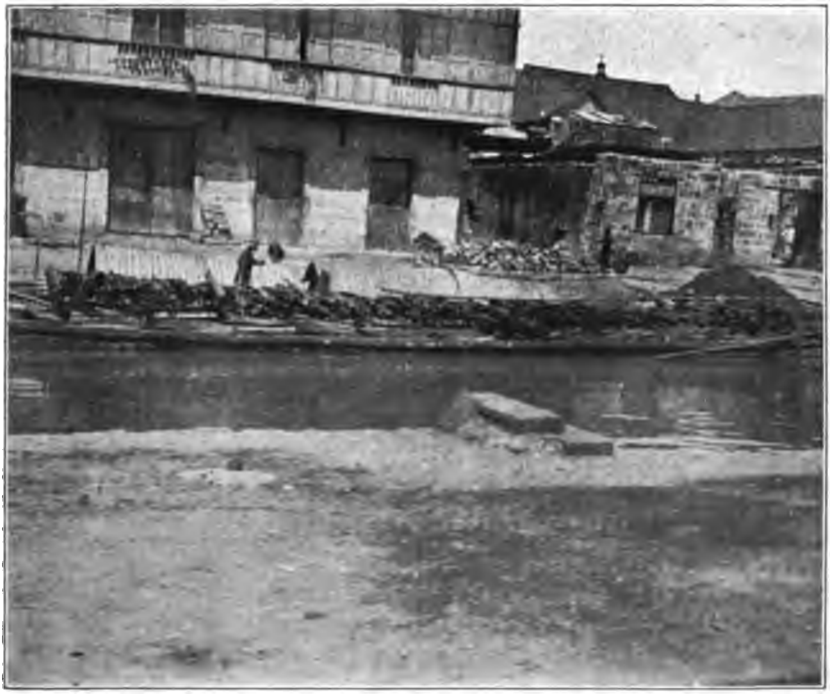

Fig. 2. Loroha load of rajitas.

PLATE XLIII.

it would appear that the moisture content is fairly constant for the different species. Cox found that in the Philipines, where the humidity is high and fairly constant, the variations in the moisture content are much less than where the climate is hot or cold, moist or dry, according to the season. He concluded that the moisture content of wood seldom falls below 12.5 or 13 per cent of the dry weight, and that these figures may be taken as good averages for thoroughly seasoned firewoods. The ash content varies considerably in different species. Cox says of the ash content that this is of comparatively little importance from the standpoint of firewood because the amount of ash is usually small. The calorific value based on the dry weight of the various species is fairly constant, as might be expected from the fact that the part of the wood left after deducting the water and ash would be almost the same in all cases.

TABLE XXI.—*Specific gravities of Philippine firewoods.*

[The numbers and common names are those given by Cox in the original table. The scientific names have been inserted by Mr. E. E. Schneider, wood expert of the Bureau of Forestry, after a recent examination of specimens of the wood used by Cox.]

No.	Common name.	Scientific name.	Moisture.	Ash.	Specific gravity.
			Per cent.	*Per cent.*	
3	Pototan	*Bruguiera conjugata*	13.58	1.46	0.7671
			13.51	1.44	0.7441
4	Bacauan	*Rhizophora mucronata*	[b]12.10	2.29	[c]0.9861
			[d]11.46	2.23	[c]0.9801
5	Bacao	*Bruguiera* sp		1.81	
				1.74	
6	Bacauan-tubig	*Bruguiera* sp	12.26	5.75	0.8799
			11.88	5.57	0.8732
7	Catutan	*Burguiera* sp	13.24	1.29	0.9136
			13.03	1.28	0.8868
8	Tabigue	*Xylocarpus moluccensis*	13.71	2.80	0.7412
			12.73		0.7333
9	Bacauan	*Bruguiera* sp	13.07	2.12	0.996
			12.77	2.05	0.991
10	Tambu-tambu	*Xylocarpus moluccensis*	[b]13.00	2.72	0.5954
			[d]12.50	2.71	0.5668
11	Pagatpat	*Sonneratia caseolaris*	12.94	2.65	0.6688
			12.83	2.62	0.5867
14	Bacauan	*Rhizophora candelaria*	12.78	2.41	[e]1.071
			12.45	2.26	[e]1.002
15	Tangal	*Ceriops tagal*	13.25	1.60	0.890
			13.09		0.880
16	Pototan	*Bruguiera conjugata*	13.24	1.55	0.9426
			12.63		0.9336
17	Lenggadi	*Bruguiera parviflora*	13.37	1.65	0.8936
			13.32		0.8881
18	Pagatpat	*Sonneratia caseolaris*	(a)		0.8186
19	Pagatpat	*Sonneratia caseolaris*	(f)		0.8447

[a] Air-dry.
[b] Heartwood beginning to form.
[c] The heartwood sinks.
[d] Sapwood.
[e] Heavier than water.
[f] Unseasoned.

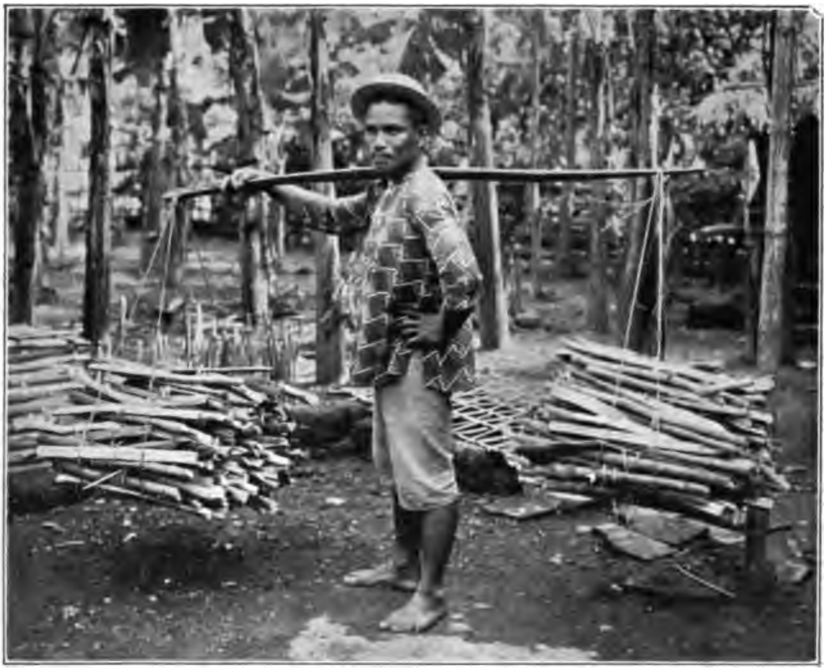

Fig. 1. Marketing firewood in Manila.

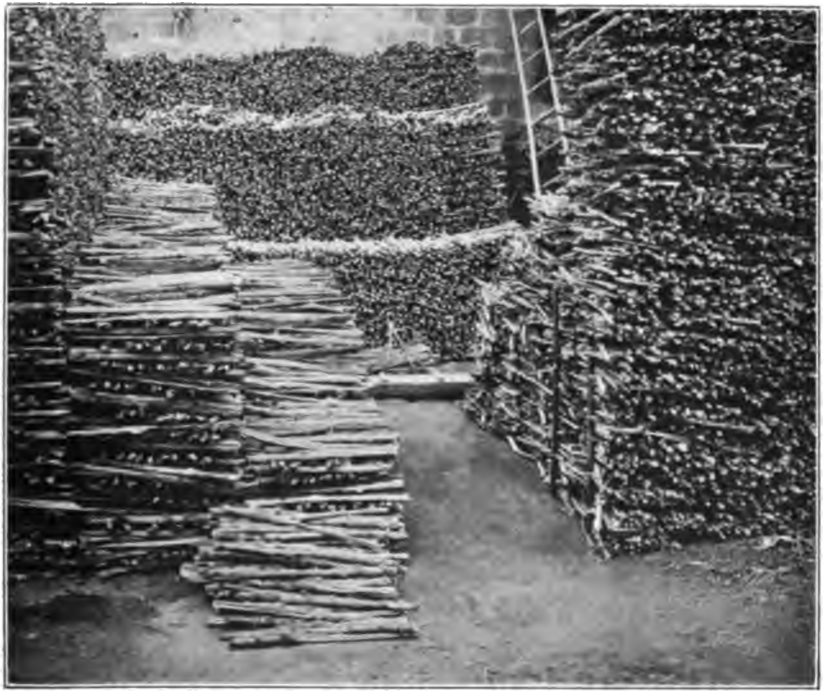

Fig. 2. Firewood piled for sale in the Manila market.

PLATE XLIV.

In Table XXI are given the specific gravities of various mangrove-swamp woods as determined by Cox. From this table it will be seen that the woods of the Rhizophoraceae have a high specific gravity, averaging about 0.9. Usually the mature heartwood of all Rhizophoraceae sinks in water. As all well-seasoned woods have very nearly the same calorific value per unit of weight, the specific gravity is highly important in determining the relative fuel value of different woods. The specific gravity also indicates certain other factors. In general it may said of woods otherwise equal, that those with low specific gravities kindle easily and flash quickly, the fire spreading rapidly; while those of high specific gravity behave in the opposite way.

From the determinations of specific gravity, Cox has made comparisons of the fuel value of certain North American woods and of the mangrove-swamp species of the Philippines. Good woods include those having specific gravities between 0.60 and 0.75. Among the North American species classed as good are hard pines, maple, ash, beech, birch, elm, black walnut, and a number of different oaks. The only mangrove-swamp wood placed by Cox in this class is tinductinducan (*Aegiceras corniculatum*). Very good woods are those with specific gravities between 0.75 and 0.90. North American woods included in this class are some of the oaks and various species of hickory. In this class Cox includes tabigue (*Xylocarpus moluccensis*), pagatpat (*Sonneratia caseolaris*), and langarai (*Bruguiera parviflora*). Cox does not mention any of the North American species as having excellent woods, that is with a specific gravity greater than 0.9. In this class are included pototan (*Bruguiera conjugata*), bacauan (*Rhizophora mucronata*), catutan (*Bruguiera* sp.), tangal (*Ceriops* spp.). This comparison emphasizes the very high value of the mangrove-swamp species for firewood.

In Table XXII are given the analyses and calorific determinations made by Cox on air-dried bark.

TABLE XXII.—*Analyses and calorific determinations of air-dried bark.*

[The numbers and common names are those given by Cox in the original table. The scientific names have been inserted by Mr. E. E. Schneider, wood expert of the Bureau of Forestry, after a recent examination of specimens of the wood used by Cox.]

No.	Common and scientific names.	Moisture.	Ash.	Main calories.[b]	Available heating value.	Heating value of combustible matter, wood—(water +ash) in main calories.	Available heating value of combustible matter, wood—(water +ash).
		Per cent.	*Per cent.*		*Calories.*		*Calories.*
3	Pototan (*Bruguiera conjugata*)	18.90	6.72	3,983	3,668	4,863	4,568
4	Bacauan tubig (*Rhizophora mucronata*)	10.23	10.37	3,971	3,664	4,884	4,575
6	Bacauan (*Bruguiera* sp.)	15.67	8.19	4,054 4,084	3,708 3,692	5,124 5,099	4.791 4,771
7	Catutan (*Bruguiera* sp.)	16.27	4.60	4,037	3,710	4,920	4,624
8	Tabigue (*Xylocarpus moluccensis*)	16.21	7.93	3,848	3.488	4,857	4,510
9	Bacauan (*Bruguiera* sp.)	15.70	8.17	3,891	3,565	4,903	4,594
10	Tambu-tambu (*Xylocarpus moluccensis*)	15.74	8.39	3,841	3,536	4,853	4,571

[b] See footnote "a" of Table XXI.

Concerning the relative value of mangrove-swamp woods and imported coal we may quote the following from Cox:

> The available heating value of any well-seasoned wood is about 3,680 calories, and the specific gravity of well-seasoned mangrove wood (Rhizophoraceae) is about 0.9. From the latter value the weight of a solid cubic meter of meter lengths is about 900 kilograms and of a solid cord (8 by 4 by 4 English feet) is about 3,260 kilograms. In some parts of the Philippine Archipelago 2 cubic meters (2 by 1 by 1 meters) are called a talacsan. Since there are generally 35 per cent of voids, or interstices, in wood of a meter or more in length, one actually obtains about 585 kilograms and 2,120 kilograms of this wood in a cubic meter and in a cord, respectively. The available calorific (fuel or heating) value of green wood is less than of dry wood by an amount not only proportional to the decreased wood fiber per unit weight, but also by the amount of heat necessary to evaporate and be carried away by the excess moisture, and that of green mangrove wood containing 38 per cent water is about 2,420 calories. * * * A commercial concern found that a cord of green mangrove wood cotained about 18 per cent more water than well-seasoned wood weighing 2,550 kilograms, which checks with these numbers. The available heating value of an average imported coal (Tagawa) is approximately 6,500 calories. From the above numbers it may be computed that, in general, a ton of this coal is theoretically equivalent to 3 cubic meters or 0.83 cord of air-dry Philippine mangrove wood and to 3.24 cubic meters or 0.89 cord of green mangrove wood containing 38 per cent moisture. In the latter case 42 per cent extra weight will have to be handled. However, various consumers report the use in actual practice of one and one-third or more cords of wood in lieu of 1 ton of coal.

In view of data given above it is not surprising that the mangrove-swamp species are highly prized for firewood, that the swamps near the centers of population have been largely depleted of the more valuable species, and that bakauan is raised in plantations.

TANBARKS

The mangrove barks constitute the greatest single source of tanning material in the Philippines. The species of mangrove trees which are used commercially for tanning purposes grow in the Philippines in large numbers. The export of mangrove tanbarks and of the bark extract, known as cutch, is an important industry in some tropical countries. In the Philippines this industry has never been developed, and the barks are used locally to only a limited extent; although there are extensive swamps in the Archipelago. The Philippines possesses an advantage over such countries as Borneo in that owing to a large population the wood can be used as firewood; so that it would seem advisable to combine the bark collection with the cutting of firewood.

Extensive anlyses of Philippine mangrove-swamp barks have been made by Bacon and Gana * and by Williams.† In Table XXIII are given the results of analyses made by Bacon and Gana of barks from Mindanao; and in Table XXIV analyses of barks from Mindoro made by the same workers. Table XXV gives the results of analyses of barks submitted by the Bureau of Forestry to the Bureau of Plant Industry at Washington. These figures are published by Williams. In Table XXVI are given the results of analyses made by Williams. Table XXVII shows the results of analyses made on barks from Sarawak, Borneo.

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* Bacon, R. B., and Gana, V. Q., The economic possibilities of the mangrove swamps of the Philippines, Philippine Journal of Science, Sec. A, Vol. 4 (1909), pages 205 to 210.

† Williams, R. R., The economic possibilities of the mangrove swamps of the Philippines, Philippine Journal of Science, Sec. A, Vol. 6 (1911), pages 45 to 61.

TABLE XXIII.—*Analyses of mangrove-swamp barks from Port Banga, Zamboanga.*

[Data from Bacon and Gana.]

Common name.	Scientific name.	Moisture.	In parts per 100 of water-free bark.			
			Insolubility.	Total extract.	Non-tannin.	Tannin.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Busain	*Bruguiera conjugata* (Linn.) Merr.	16.1	63.0	36.96	9.8	27.2
Do	do	13.5	62.0	38.0	13.5	24.5
Lañgárai	*Bruguiera parviflora* W. and A.	13.9	84.1	15.9	7.1	8.8
Do	do	13.8	80.4	19.6	8.0	11.6
Tañgál	*Ceriops tagal* (Perr.) C. B. Robinson.	12.4	65.2	34.8	11.6	23.2
Do	do	11.9	58.6	41.4	19.1	22.3
Bakáuan-lalaki	*Rhizophora candelaria* DC.	13.4	68.7	31.3	13.3	18.0
Bakáuan-babaye	*Rhizophora mucronata* Lam	14.4	61.7	38.3	12.4	25.9
Tabigue	*Xylocarpus granatum* Koen	14.9	69.7	30.3	8.6	21.7
Do	do	14.2	67.6	32.4	7.7	24.7

TABLE XXIV.—*Analyses of mangrove-swamp barks from Mindoro.*

[Data from Bacon and Gana.]

Common name.	Scientific name.	Moisture.	In parts per 100 of water-free bark.			
			Insolubility.	Total extract.	Non-tannin.	Tannin.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Busain	*Bruguiera conjugata* (Linn.) Merr.	18.9	60.2	39.8	11.6	28.2
Do	do	13.9	63.4	36.6	12.6	24.0
Lañgárai	*Bruguiera parviflora* W. and A.	14.0	77.4	22.4	9.6	12.8
Do	do	14.8	75.5	24.5	9.6	14.9
Do	do	12.9	82.1	17.9	8.3	9.6
Tañgál	*Ceriops tagal* (Perr.) C. B. Robinson.	11.8	69.1	30.9	9.7	21.2
Do	do	12.3	72.5	27.5	10.5	17.0
Do	do	12.7	71.5	28.5	8.0	20.5
Bakáuan-lalaki	*Rhizophora candelaria* DC.	13.2	67.4	32.6	12.0	20.6
Do	do	13.5	64.8	35.2	10.8	24.4
Do	do	14.4	66.6	33.4	10.7	22.7
Do	do	14.1	67.1	32.9	10.0	22.9
Bakáuan-babaye	*Rhizophora mucronata* Lam.	13.2	64.3	35.7	14.1	21.6
Do	do	13.4	67.1	32.9	15.1	17.8

TABLE XXV.—*Analyses of Philippine mangrove-swamp barks submitted by the Bureau of Forestry to the Bureau of Plant Industry at Washington.*

[Data from Williams.]

Common name.	Scientific name.	Total solids.	Soluble solids.	"Reds."	Non-tannin.	Tannin.
Lañgárai	*Bruguiera parviflora* W. and A.	24.43	19.82	4.61	7.27	12.55
Potótan	*Bruguiera sexangula* (Lour.) Poir.	37.36	36.81	0.55	10.15	26.66
Tañgál	*Ceriops tagal* (Perr.) C. B. Rob.	58.58	49.02	9.56	13.19	35.83
Bakáuan	*Rhizophora candelaria* DC.	53.91	51.03	2.88	11.64	39.39

TABLE XXVI.—*Analyses of Philippine mangrove-swamp barks.*

[Data from Williams.]

Species.	Number of determinations.	Average of determinations.
Bruguiera conjugata (Linn.) Merr.	13	32.4
Bruguiera sexangula (Lour.) Poir		
Bruguiera parviflora W. and A	14	9.1
Ceriops tagal (Perr.) C. B. Rob	5	31.3
Rhizophora candelaria DC	9	27.8
Rhizophora mucronata Lam	23	27.6
Sonneratia caseolaris Linn	4	11.8
Xylocarpus moluccensis (Lam.) M. Roem	2	23.0
Xylocarpus granatum Koen	2	23.2

TABLE XXVII.—*Analyses of mangrove-swamp barks from Sarawak, Borneo.*[a]

[Data from Bacon and Gana.]

Common name.	Scientific name.	Moisture.	Insolubility.	Total extract.	Non-tannin.	Tannin.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Busain	*Bruguiera conjugata* (Linn.) Merr.	15.5	64.3	35.7	9.0	26.7
Potótan	*Bruguiera sexangula* (Lour.) Poir.	16.1	64.0	36.0	8.0	27.2
Tañgál	*Ceriops tagal* (Perr.) C. B. Robinson.	13.8	63.8	36.2	6.9	29.3
Bakáuan-lalaki	*Rhizophora candelaria* DC.	14.7	58.3	41.7	9.6	32.0
Bakáuan-babaye	*Rhizophora mucronata* Lam	14.4	70.1	29.9	9.4	20.5

[a] Analysis was made of some samples of mangrove barks brought from Sarawak, Borneo, by Dr. Foxworthy, of the botanical division of this Bureau. These barks are used by cutch factories and among the species in Borneo probably yield the highest amount of tannin.

TABLE XXVIII.—*Yield of bark from mangrove trees of different sizes.*

[Data from Foxworthy and Matthews.]

Diameter.	Species.			
	Rhizophora candelaria.	Rhizophora mucronata.	Bruguiera conjugata and Bruguiera sexangula.	Ceriops tagal and Ceriops roxburghiana.
Inches.	*Kilos.*	*Kilos.*	*Kilos.*	*Kilos.*
3	4	4	3	2
4	6	6	5	3
5	12	11	7	5
6	21	19	9	9
7	30	30	16	13
8	41	41	18	21
9	56	52	24	30
10	72	66	30	40
11	90	83	39	54
12	110	98	47	----------
13	133	121	57	----------
14	157	145	66	----------
15	193	178	78	----------
16	236	223	91	----------
17	287	266	103	----------
18	----------	----------	120	----------
19	----------	----------	139	----------

In Table XXVIII is shown the yield of bark from trees of different sizes of *Rhizophora candelaria, Rhizophora mucronata, Bruguiera conjugata* and *Bruguiera sexangula,* and *Ceriops tagal* and *Ceriops roxburghiana.* The figures in this table were calculated from a table by Foxworthy and Matthews.*

Very various results have been obtained by analyzing the barks of the same species, and it has been often stated that the bark from some countries is richer in tannin than that from others. Williams † says that the percentage of tannin increases with the size of the tree. He believed, however, that this increase was due rather to the age than to the size. In drying, barks also lose a certain portion of their tannin, especially if not properly dried. Owing to these facts and to the varied results obtained by analyses it is questionable as to whether or not bark of the same age has a different tannin content in different regions. The barks from East Africa are, however, reported to be richer in tannin than those from the Indo-Malayan region. The Philippine barks certainly appear to be as rich as those in Borneo which have been used in cutch factories. Owing to the relatively low price that the crude barks command and the expenses of shipping, it would probably be advisable to export cutch rather than the crude barks.

---

* Foxworthy, F. W. and Matthews, D. M., Mangrove and nipah swamps of British North Borneo, Department of Forestry Bulletin No. 3 (1917), page 16.

† Williams, R. R., The economic possibilities of the mangrove swamps of the Philippines, Philippine Journal of Science, Sec. A, Vol. 6 (1911), pages 45 to 61.

Cutch is not only used as a tanning material but also as a dye. A short history of the uses of cutch has been given by Foxworthy.* The name cutch was originally applied to a product of the heartwood of *Acacia catechu* Willd., which has been known from India and Burma for many years.

TABLE XXIX.—*Amount of tanbarks and dye barks on which forest charges were paid in the Philippine Islands from 1914 to 1918, inclusive.*

Year.	Tanbarks.	Dye barks.
	Kilos.	*Kilos.*
1914	2, 793, 295	58, 714
1915	1, 913, 558	94, 492
1916	1, 543, 686	93. 057
1917	8, 165, 687	84, 364
1918	1, 973, 786	148, 764

The supply was however not entirely uniform or reliable. When the product from the mangrove trees came into the market it superseded the Indian cutch to such an extent that this term is now used mainly with reference to the mangrove extracts. With the advent of the common use of aniline dye it was found that the Bismark browns furnished a cheaper and a more easily handled dye than cutch and, consequently, the use of the latter as a dye gradually ceased.

The bark of *Ceriops* spp. is used locally for coloring rice and tuba and for dyeing. The bark of *Xylocarpus granatum* is also used locally to a considerable extent for dyeing purposes. The dyeing property of the barks of *Ceriops tagal* and *Xylocarpus granatum* is not great, and they are of more use as mordants. They are, however, used in large quantity for dyeing fishnets, ropes, sails, and clothing used in salt water. Table XXIX shows the amount of tanbarks and dye barks upon which forest charges were paid from 1914 to 1918. The barks consisted very largely of mangrove-swamp species, the dye barks chiefly of *Ceriops* spp. and *Xylocarpus granatum.*

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* Foxworthy, F. W., Cutch, Philippine Journal of Science, Sec. A, Vol. 3 (1908), page 534.

Many mangrove swamps in the Philippines have been so thoroughly depleted of the larger-sized and more valuable trees that even though they cover extensive areas they would not be capable of supporting a cutch factory. However, there are areas in Mindanao, Mindoro, and Palawan which, although they may not be as large as some in Borneo, still offer promising sites for cutch factories. In Sibuguey Bay, Mindanao, there is a well developed swamp covering an area of 25,000 hectares. Concerning this area Williams † says:

> I have found that this area will yield about 20 metric tons per hectare of fresh bark of mature trees of selected species averaging about 28 to 30 per cent of tannin on the dry weight. Only four species are included in this estimate, all others being negligible from a commercial standpoint. The natural resources are sufficient for a profitable industry, the swamps being fully as valuable, hectare for hectare, as many now being worked in the East Indies.
>
> A survey of the data shows that only four species can be depended upon to furnish a supply of bark. They are *Rhizophora mucronata*, *Rhizophora conjugata* [*candelaria*], *Bruguiera gymnorrhiza* [*conjugata*], and *Bruguiera eriopetala* [*sexangula*], the two former commonly known as "bacauan" (bakáuan-lalaki and bakáuan-babaye respectively), the two latter as "pototan" or "pitutan." Tañgal, which is the "teñgah" bark of Borneo upon which the manufacturers there depend to a considerable extent, is scarce on Sibuguey Bay. Both *Xylocarpus granatum* and *Xylocarpus obovatus* [*granatum*] yield too small quantities of bark per tree to be remunerative. *Bruguiera parviflora* has a very low tannin content, as has *Sonneratia pagatpat* [*caseolaris*].
>
> However, a use may be found for the last mentioned for blending with the more valuable barks, since it produces a leather of good, brown color, very different from any tanned by barks of the Rhizophoraceae.
>
> In calculating the yield of bark in the area examined, only bacauan and pototan tree 20 centimeters or more in diameter have been counted. For this purpose seven rectangular areas of about one-fourth hectare each were selected as representative after a fairly through exploration of the surrounding swamp. These areas are distributed at approximately regular intervals between the mouths of the Vitali and Buluan Rivers. The yield of bark per tree was determined by felling three representative trees each of bacauan and pototan and stripping and weighing the bark. Bacauan averaged 140 kilograms per tree, pototan 190 kilograms. On this basis the area will yield 20.6 metric tons of bacauan bark per hectare, and 5.8 tons of pototan. We may safely state the yield at 20 tons per hectare of bark.

In Mindoro there is a tract of 10,000 hectares and in Palawan a fairly compact area of good swamp. The swamps in the other islands of the Archipelago are so scattered as to make the success of a cutch factory doubtful.

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† Williams, R. R., The economic possibilities of the mangrove swamps of the Philippines, Philippine Journal of Science, Sec. A, Vol. 6 (1911), page 47.

Concerning the manufacture of cutch from Philippine materials Bacon and Gana * write as follows:

> There are three large cutch factories in Borneo using tan barks from the same species of mangrove as those found in the Philippines. These factories regard the process of manufacturing cutch as a trade secret, but we can not believe that these so-called trade secrets are of a very formidable nature, as we have succeeded in preparing very good grades of cutch without any complicated processes in this laboratory. Our cutch is a dry, brown solid with a brilliant, almost metallic, fracture. It is easily and completely soluble in water and the analysis shows the following constituents:

Constituent.	In parts per 100 of water-free material.	
	I.	II.
	Per cent.	*Per cent.*
Moisture	2.6	5.7
Insoluble	1.9	1.3
Soluble	98.1	98.7
Non-tannin	28.8	26.1
Tannin	69.3	72.6

> The following was the method used to prepare the cutch:
>
> The finely ground bark was leached with cold water, and this solution evaporated to dryness *in vacuo*. Hot water extracts too much of the coloring matter, and no more tannin than cold water. The evaporation, at least the latter stages, must always be made *in vacuo* to avoid burning the cutch. It is sufficiently obvious that the extraction on a large scale would be carried out in such a manner that strong solutions would be employed to leach fresh bark while weak ones would be used to extract the last percentages of the tannin from the partly exhausted bark. All the parts of the factory, except the vacuum dryers, could be built on the ground, and it is evident that the fuel for the boilers and for the dryers would cost very little, so that it would appear that if the cutch manufacture were taken up in connection with the lumbering or firewood industry that it would be exceedingly profitable.

The chief objection to the use of cutch as a tanning material seems to be that it produces a reddish brown leather which is somewhat harsh and thick-grained, due to the high astringency of the tannin; but when mixed with other materials it gives a very satisfactory tannage.†

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* Bacon, R. F. and Gana, V. Q., The economic possibilities of the mangrove swamps of the Philippines, Philippine Journal of Science, Sec. A, Vol. 4 (1909), pages 206 to 207.

† Williams, R. R., The economic possibilities of the mangrove swamps of the Philippines, Philippine Journal of Science, Sec. A, Vol. 6 (1911), page 56.

ECONOMIC USES OF THE NIPA PALM

THATCHING

Economically the nipa palm takes a very high rank among the plants of the Philippines. Throughout the Islands, except in inaccessible regions, the leaves are used extensively for thatching. Most of the people dwell in light-construction houses, and nipa is by far the commonest material used for thatching such dwellings. Nipa shingles are also sometimes used for the walls of houses. As nipa roofs take fire readily and a fire in a nipa district spreads with great rapidity and can be controlled with great difficulty, if at all, the use of this material for thatching houses has now been prohibited in a considerable portion of the city of Manila and other large towns.

The nipa shingles are made by removing the leaflets from the petiole, and doubling back one-third of the length of the leaflet over a slender piece of bamboo, the leaflets being so placed that they overlap. They are then sewed in place to form an oblong shingle, usually about 70 centimeters in length. In Pampanga a woman will, as a rule, prepare from four hundred to five hundred of these shingles in a day, and some will make as many as eight hundred a day. The shingles are usually tied in bundles of ten to facilitate handling them.

OTHER USES OF LEAVES

The leaflets are not only used for building purposes, but also for making raincoats and sun hats (salacots), coarse baskets, mats, and bags. The midribs of the leaves are used for tying bundles of rice, for sewing nipa shingles, and for making coarse brooms. The petioles are employed as fuel, while splints prepared from the cortex are sometimes used for making baskets.

SEEDS

The immature seeds are used for food, the taste and the consistency being similar to those of the flesh of immature coconuts. They are sometimes made into a kind of sweetmeat. The mature seeds are too hard to be eaten.

ALCOHOL

Nipa is very important as a source of alcohol and vinegar, and is a promising source of sugar. This subject has been extensively investigated by Gibbs,* from whose article most of the information on this subject is taken. The production of proof alcohol in the Philippines exceeds thirteen million liters annually, and about 55 per cent of this is the product of the nipa palm. The alcohol is obtained by distilling the fermented juice which flows from a cut inflorescence stalk after the fruiting head has been removed. As the inflorescence of the nipa is near the ground, the flower stalk is conveniently situated for the gathering of the sap, called tuba. Some time after the fruit is formed, the stalk is cut across near its top, usually just below the fruit; and each day a thin slice is removed to keep the wound fresh and to facilitate exudation. If the plant bears two flower stalks the usual practice is to take sap from only one, the other being removed.

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* Gibbs, H. D., The alcohol industry of the Philippine Islands. Part I, Philippine Journal of Science, Sec. A, Vol. 6 (1911), pages 99 to 145.

Sap is collected in bamboo joints which are hung on the stem. These containers are about 45 centimeters high and 8 centimeters in diameter and have a capacity of about 2 liters (Plate XLV). The stalk usually flows for about three months, but it is not uncommon for it to be cut away, or at least cut so close to the ground that the daily paring is impracticable, long before the flow has ceased. In some districts the stem is cut before the fruit is formed and under such conditions the daily yield of sap is said to be increased, but the period of flow reduced from three to one and one-half months, the total yield being practically the same in both cases. The season of gathering the juice is usually of about six months' duration.

Gibbs came to the conclusion that with the present method of caring for a nipa area an average plant would produce 43 liters of sap during the season, while a conservative estimate † places the number of palms in a cultivated swamp at between 2,000 to 2,500 per hectare, of which 750 may be depended upon to produce fruiting stalks and consequently be available for sap collection.

Gibbs gave the following composition for sap of the best quality:

Density 15°/15°	1.0720
Total solids	18.00
Ash	0.48
Acidity	Trace.
Sucrose	17.00
Reducing sugars	Trace.

---

† Gibbs, H. D., The alcohol industry of the Philippine Islands. Part I, Philippine Journal of Science, Sec. A, Vol. 6 (1911), pages 99 to 145.

† Pratt, D. S., Thurlow, L. W., Williams, R. R., and Gibbs, H. D., The nipa palm as a commercial source of sugar, Philippine Journal of Science, Sec. A, Vol. 8 (1913), pages 377 to 398.

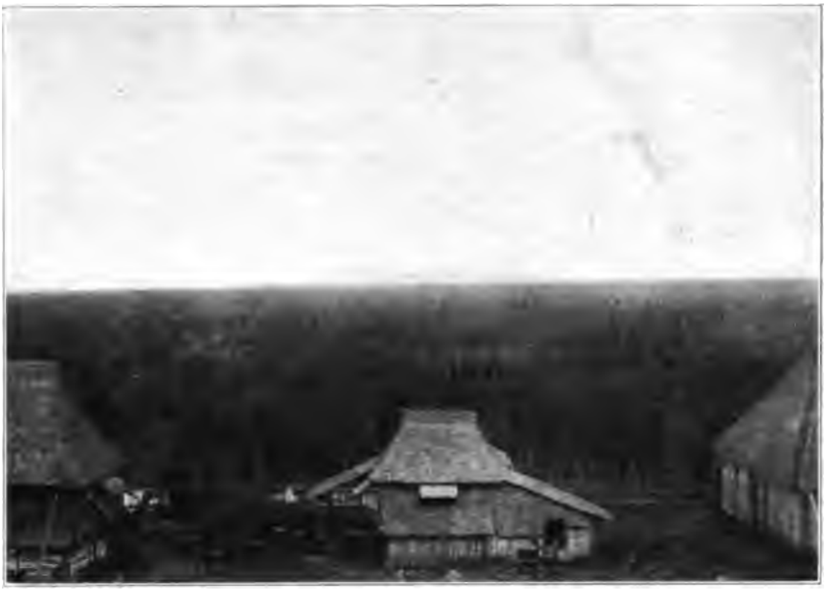

Fig. 1. Nipa swamps as far as the eye can reach.

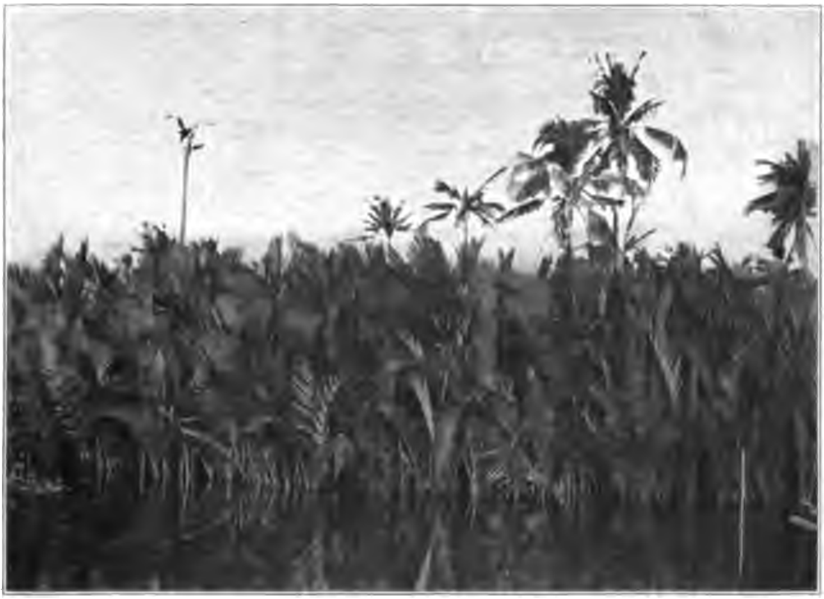

Fig. 2. Uncultivated nipa swamp.

PLATE XLV.

He found that the inversion of the sucrose began after the sap is dropped from the stem and concluded that it was due to the formation of an enzyme.

Tuba is carried by small boats (bancas) from the place of collection to the distilleries. According to Gibbs the inversion is complete and the alcoholic fermentation well under way and sometimes completed before the sap arrives at the distillery. Sometimes the acetic acid fermentation has progressed to a considerable extent. The yield of alcohol obtained from the sap varied from 4.1 to 7.5 per cent, the average for thirty-three distilleries was 5.6 per cent. Due to faulty methods the yield of alcohol is not what it should be. The average price paid for the sap at the distillery is, according to Gibbs, 0.006 peso per liter. Gibbs says that the alcohol produced from the nipa sap should be about 6 per cent of the tuba, and under favorable conditions he believes above 7 per cent. With a yield of 6.5 per cent alcohol, the purchase price of the raw material would be equivalent to a cost of 0.0415 peso to 0.0830 peso per liter for 90 per cent alcohol. His estimates would indicate that nipa sap is the cheapest known source of alcohol. For manufacturing alcohol, nipa possesses several advantages over grains in that it does not need purification, pulping, etc. The storage space and fermentation vats may also be smaller, since fermentation is complete in from six to ten hours and the material ready to be distilled. Gibbs estimates that the owner of a nipa area by selling sap clears about 129 pesos per hectare per annum.

In some distilleries, especially in those near sugar cane lands, molasses is added to the fermenting sap. The molasses, which usually contains about 60 per cent of fermentable carbohydrates, is sometimes used in amounts equal to that of the tuba. According to Gibbs the advantages are threefold: The invertase and alcoholic ferment in the tuba act with great rapidity upon the molasses, providing an easy method for the utilization of the latter; the production of alcohol is greatly increased; and when there is a shortage in the supply of sap, the uninterrupted running of the stills is assured. The use of molasses during a portion of the season enables some distilleries to operate during the entire year.

TUBA

The fermented juice (tuba) of the nipa palm is used extensively by the Filipinos as a beverage. It resembles apple cider in appearance and flavor.

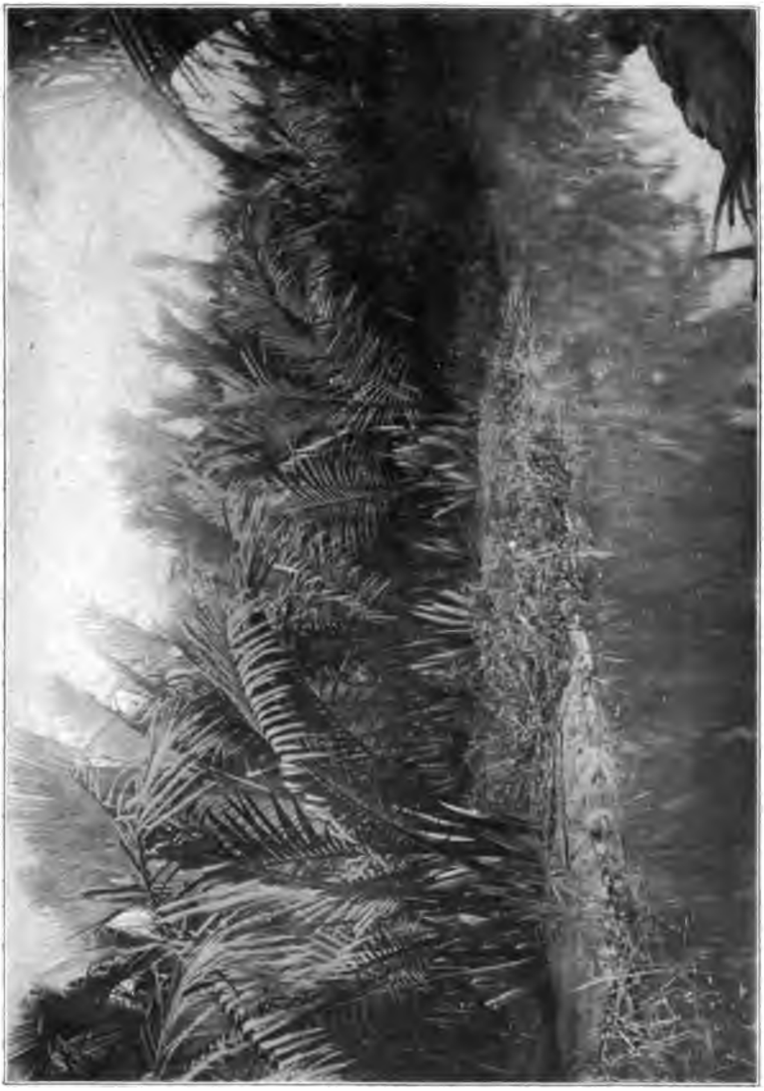

PLATE XLVI. CULTIVATED NIPA SWAMP.

VINEGAR

Considerable quantities of vinegar are manufactured from nipa tuba by allowing acetic fermentation to follow alcoholic fermentation. The methods at present used are very crude and the product inferior, containing only from 2 to 3 per cent acetic acid.

CULTIVATION OF NIPA

A considerable amount of capital is invested in the nipa-alcohol industry, large distilleries exist in various nipa swamps, and the swamps themselves have been improved. Artificial channels have been dredged, to make the nipa areas more accessible for the purpose of gathering and transporting the sap, and in some places the nipa areas have been extended by planting, yet at the present time only a small part of the available "nipales" is commercially utilized.

The best publication on the cultivation of nipa is a small pamphlet published in Manila in 1906, by Enrique Zobel, entitled "Estudio de la planta nipa." The following information is taken largely from this publication:

Nipa is planted in the months from May to July, the seeds being placed in holes 1.7 to 2 meters apart. The period of development does not exceed four years in which time flowers are produced and the plant can be utilized for the production of alcohol. During the first year the plant grows from 1.5 to 2 meters. The seeds carried by water and deposited on land under shade seem to develop better and to produce healthier plants than those artificially planted in the open. Nipa is not only reproduced by seeds but also by the branching of the rhizome. In order to keep a nipal (nipa swamp) in good condition, the plants must be thinned until they are from 1.5 to 1.7 meters apart. In doing this it is necessary to cut up the roots of the plants removed to prevent their regeneration. At the end of two years a nipa plant has seven to eight leaves, and this number is maintained throughout its life. If a nipa swamp is cultivated for the sap, the fresh leaves should not be cut, while it is very advantageous to remove the drooping or drying leaves which can be used for thatching houses, etc. When roofing material and not tuba is desired, three or four fresh leaves may be cut, but this interferes with the development of the plant and greatly decreases the flow of tuba.

If nipa is cultivated for alcohol, care should be taken not to injure the plant at the time of flowering, as an injury at this

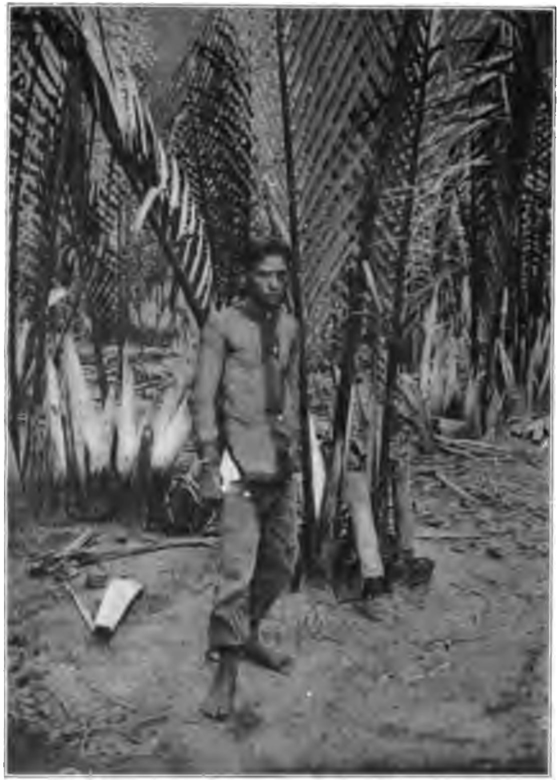

Fig. 1. Collecting the nipa sap.

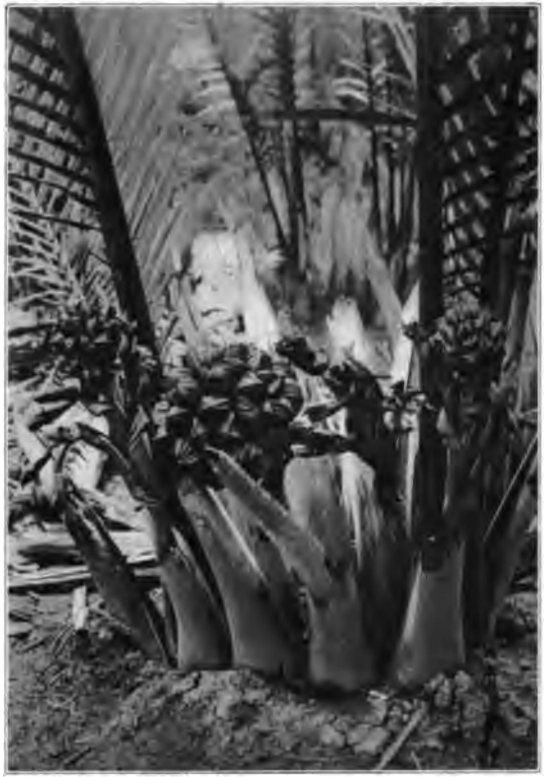

Fig. 2. Nipa palms in fruit.

PLATE XLVII.

time is likely to cause the flower to die. The first thing done before the gathering of sap is the cleaning of the nipal. The ground is cleared of weeds and vines and any other obstacles that interfere with the workman passing between the plants to collect tuba. At this time the mature leaves are cut off, tied into bundles, and transported to the houses where the women make the nipa shingles.

SUGAR

It is possible that the nipa palm may prove to be a profitable commercial source of sugar. This subject has been quite extensively investigated by chemists of the Bureau of Science,* with the following general results: With a normal average of sap flow of from 30 to 50 liters per plant over a period of three months, with a sap-collecting period of six months, and with an average of 750 bearing trees per hectare, it was found that 1 hectare would produce an average quantity of 30,000 liters of sap. The cost of collection and delivery at a sugar mill was found to be about 3 pesos per 1,000 liters; and the sugar yield about 115 kilograms of commercial white sugar, polarizing at 99 or above, per 1,000 liters of sap. The palm juice has the advantage over cane juice of being free from acids, waxes, etc., colorless, with no débris, and, when fresh, with no invert sugar. The chief difficulty in utilizing nipa as a source of sugar lies in the fact that normally fermentation commences with the flow of sap from the cut peduncle, that enzymes are present in the sap which will in time cause the complete inversion of the sucrose, and that it is difficult to prevent this inversion. With the use of a modified type of container freshly lined with lime cream and sulphite, for gathering the sap, fermentation and inversion can be prevented or inhibited for at least twelve hours, thus allowing sufficient time to collect and deliver the sap without undue loss of sucrose.

FOREST CHARGES

The mangrove-swamp areas are property of the Philippine Government and are not sold but developed under a license system. Usually small operators work under an ordinary yearly license for definite small areas. Exclusive licenses (or concessions, as they are popularly called) are generally in the form of a twenty-year exclusive license to cut and extract timber, firewood, dye and tanbarks and other minor forest products from a specific tract. The land is in no way affected as merely the timber and minor forest products are included. Areas of 10 hectares are leased for factory or mill sites free of charge, as are also all rights of way for the operation of a concession. The charges are only nominal and are collectable after the products have been gathered.

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* Gibbs, H. D., The alcohol industry of the Philippine Islands. Part I, Philippine Journal of Science, Sec. A, Vol. 6 (1911), pages 99 to 145.

* Pratt, D. S., Thurlow, L. W., Williams, R. R., and Gibbs, H. D., The nipa palm as a commercial source of sugar, Philippine Journal of Science, Sec. A, Vol. 8 (1913), pages 377 to 398.

A charge of 20 centavos per cubic meter is paid on wood cut for firewood; if cut for lumber, the charge is according to the group, Philippine wood being divided into four groups. *Lumnitzera* spp. belongs to the second group, which is assessed at 1.50 pesos per cubic meter. *Sonneratia pagatpat* and *Xylocarpus moluccensis* belong to the third group, on which there is a charge of 1 peso per cubic meter. All of the other timbers from the mangrove swamps belong to the fourth group on which a charge of 50 centavos per cubic meter is paid. Tanbarks are assessed at 30 centavos per hundred kilograms, and dye barks at 50 centavos per hundred kilograms.

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